UPS HALLEY/E 20÷80KVA

PRODUCT MANUAL

PRODUCT MANUAL

UNINTERRUPTIBLE POWER SUPPLIES

English

- ***HALLEY/E 20kVA (3Ph / 3Ph)***
- ***HALLEY/E 30kVA (3Ph / 3Ph)***
- ***HALLEY/E 40kVA (3Ph / 3Ph)***
- ***HALLEY/E 60kVA (3Ph / 3Ph)***
- ***HALLEY/E 80kVA (3Ph / 3Ph)***

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1 INTRODUCTION

1.1 ENVIRONMENT

1.1.1 ISO 14001 certification

The product was manufactured in a factory certified ISO 14001 respecting eco-design rules.

1.1.2 Packing

UPS packing materials must be recycled in compliance with all applicable regulations.

1.1.3 Lead battery

This product contains lead-acid batteries. Lead is a dangerous substance for the environment if it is not correctly recycled by specialised companies.

1.1.4 Treatment of the UPS at the end of service life

For the UPS disposal at the end of its life cycle and for the recycling of the materials, it's strongly recommended to follow the regulations in force in the country of installation.

1.2 SAFETY RULES

1.2.1 Safety of persons

The UPS must be installed in a room with restricted access (qualified personnel only, according to standard EN62040-1-2).
A UPS has its own internal power source (the battery). Consequently, the power outlets may be energised even if the UPS is disconnected from the AC-power source.

CAUTION

If primary powers isolators are installed in other area from UPS area, the following warning label must be placed on them.
"ISOLATE THE UPS BEFORE WORKING ON THIS CIRCUIT"

- **Dangerous voltage levels are present within the UPS. It should be opened exclusively by qualified service personnel.**
- **Warning, after the UPS shut-down, a dangerous voltage will be present on the battery selector BCB.**
- **The UPS must be properly earthed.**
- **The battery supplied with the UPS contains small amounts of toxic materials. To avoid accidents, the directives listed below must be observed.**
- **Never operate the UPS if the ambient temperature and relative humidity are higher than the levels specified in the documentation.**
- **Never burn the battery (risk of explosion).**
- **Do not attempt to open the battery (the electrolyte is dangerous for the eyes and skin).**
- **Comply with all applicable regulations for the disposal of the battery.**

1.2.2 Product safety

A protection circuit breaker must be installed upstream and be easily accessible.
Never install the UPS near liquids or in an excessively damp environment.
Never let a liquid or foreign body penetrate inside the UPS.
Never block the ventilation grates of the UPS.

Never expose the UPS to direct sunlight or a source of heat.

1.2.3 Special precautions

The UPS connection instructions contained in this manual must be followed in the indicated order.
Check that the indications on the rating plate correspond to your AC-power system and to the actual electrical consumption of all the equipment to be connected to the UPS.
If the UPS must be stored prior to installation, storage must be in a dry place.
The admissible storage temperature range is -10° C to +45° C.
If the UPS remains de-energised for a long period, we recommend that you energise the UPS for a period of 24 hours, at least once every month. This charges the battery, thus avoiding possible irreversible damage.
The UPS is designed for normal climatic and environmental operating conditions as defined in the "appendices" chapter: altitude, ambient operating temperature, relative humidity and ambient transport and storage conditions.
Using the UPS within the given limits guarantees its operation, but may affect the service life of certain components, particularly that of the battery and its autonomy. The maximum storage time of the UPS is limited due to the need to recharge its integrated battery.
Unusual operating conditions may justify special design or protection measures:

- harmful smoke, dust, abrasive dust,
- humidity, vapour, salt air, bad weather or dripping,
- explosive dust and gas mixture,
- extreme temperature variations,
- bad ventilation,
- conductive or radiant heat from other sources,
- strong electromagnetic fields,
- radioactive levels higher than those of the natural environment,
- fungus, insects, vermin, etc.,
- battery operating conditions.

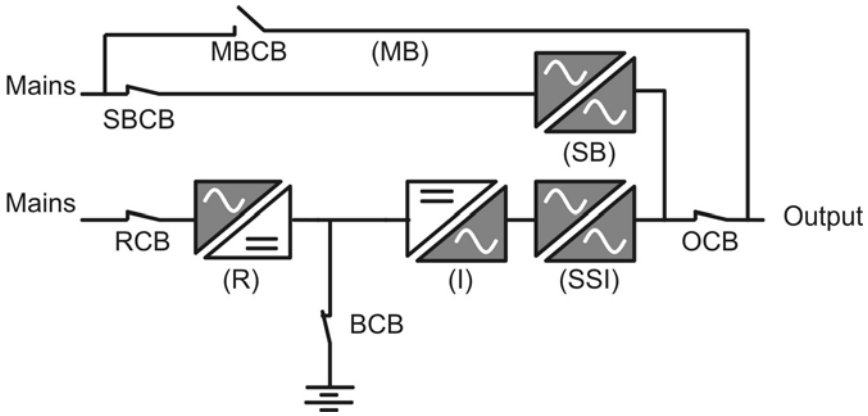
The UPS must always be installed in compliance with:

- **the requirements of HD 384.4.42 S1/A2 - Chapter 42: Protection from thermal effects.**
- **standard IEC 60364-4-482 - Chapter 482: Fire protection.**

The manufacturer declines all responsibility for damages to people or equipment deriving from non-fulfilment of the above.

2 UPS GENERAL DESCRIPTION

The UPS of the HALLEY/E series is the type “ON LINE DOUBLE CONVERSION” and is connected between main power and user loads (see picture 1). As far as architecture and lay-out is concerned, this project is optimised with particular care in order to make it suitable for applications where reliability and high performances are fundamental for critical loads.
The UPS operation is optimised by microprocessor digital control and the IGBT inverter is based on a high frequency PWM waveform.
The whole UPS is monitored by a DSP 16 bit microprocessor, implementing full digital control.
Procedures for power-on, power-off, switching to and from bypass are described step by step on LCD display, so to help users to easily operate the UPS.
Results of electrical measurement, alarm, work condition, event log and battery state are displayed real time on the LCD front panel.



Picture 1 – UPS block diagram

With this configuration UPS guarantees high quality output, needed by loads requiring stable and clean source of power. The main features are:

- Protection for black-out, in the limits of battery autonomy
- Complete filtering of main power noise
- High quality output power, provided under any condition of input power and loads
- Stable output frequency, independent from input frequency
- Full compatibility with every type of load
- Configurable with any neutral wire configuration (under request)
- Automatic control of battery, during both charging and discharging phases
- Easy to interface with user devices
- Auto-diagnostic feature and troubleshooting support
- Flexibility of complete bypass configuration
- Full access from the front and from the roof for maintenance

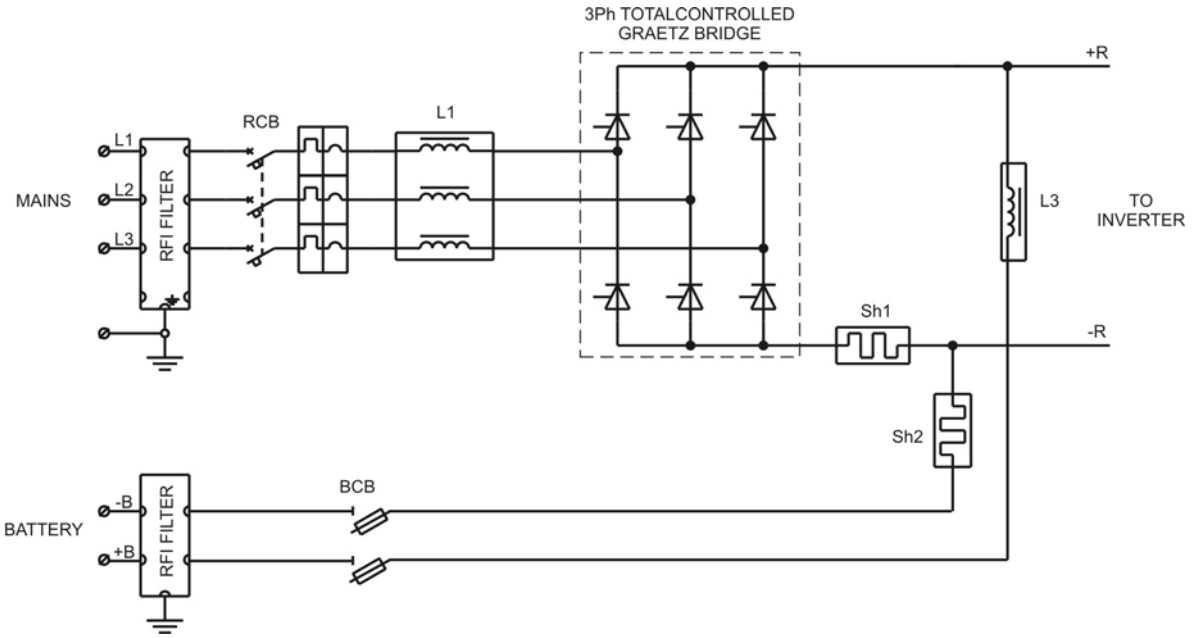
The block diagram shows the UPS subsystem that will be analysed in the following chapters:

- Rectifier/Battery Charger (R)
- Inverter (I)

- Battery (B)
- Static switch: Static inverter switch (SSI) and Static Bypass switch (SB)
- Manual Bypass (MB)

2.1 RECTIFIER / BATTERY CHARGER

The rectifier/Battery charger converts the AC input voltage to DC voltage, feeding the inverter and keeping the battery charged.



Picture 2 – Rectifier

NOTE

On HALLEY/E 40÷80kVA RCB is a fused switch and BCB is not installed.

The AC input voltage is filtered by the inductor L1 and then converted into DC by the 6 pulses phase-angle controlled rectifier, composed by six thyristors. The typical harmonic distortion of the current absorbed by a 6 pulses rectifier is shown in the table below:

Harmonic order	1	5	7	11	13	17	19	**THD**
Amplitude (I_n/I_1)	100 %	19,6 %	13,8 %	8,5 %	7,0 %	5,1 %	4,4 %	27,0 %

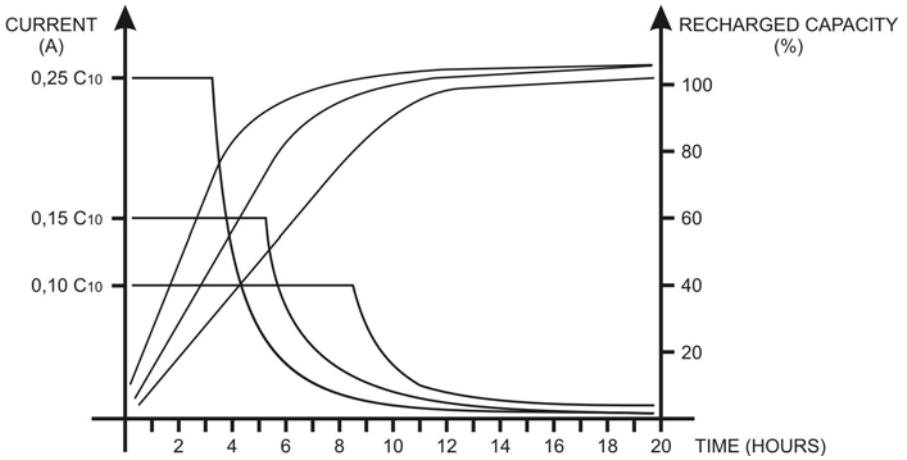
The inductor L3 reduces the current ripple generated by the inverter so that the battery life is improved. During the battery discharge the inductor L3 works like a short-circuit, so that there's no voltage drop and the battery capacity can be completely used. The rectifier is designed to recharge and keep charged Sealed Lead Acid Batteries, although Open-type Lead Acid or Ni-Cd batteries can be used. Following to the manufacturer's instructions, each type of battery must be charged according to its manufacturing technology. Basically there are two different charging methods:

- ONE CHARGING LEVEL (FLOATING CHARGE)
- TWO CHARGING LEVELS (FLOATING / BOOST CHARGE)

The double-level charging mode is generally used with Open-type Lead Acid or Ni-Cd Batteries and it's provided as option (see section OPTIONS for further details).

2.1.1 Operation with ONE charging level

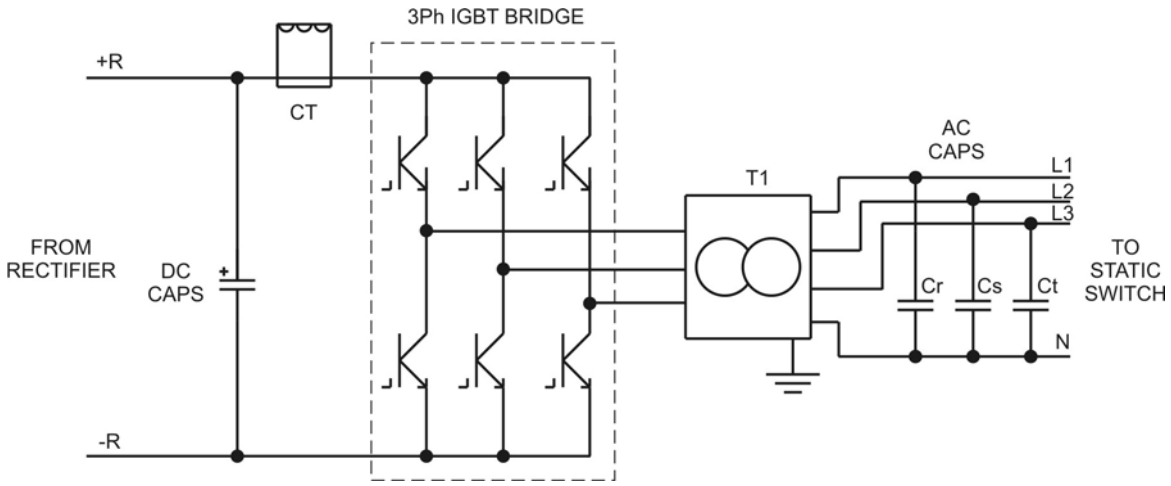
This type of charge is generally used with sealed lead acid batteries that, owing to the manufacturing technology, have a very narrow voltage range. In fact, the nominal charging voltage ranges between 2,25÷2,27 V/cell, with a maximum value of 2,3 V/cell.
The picture below shows the charging curves at different charging currents; the higher is the current, the higher is the restored capacity versus time, the lower is the recharging time.



Picture 3 – Operation with ONE charging level

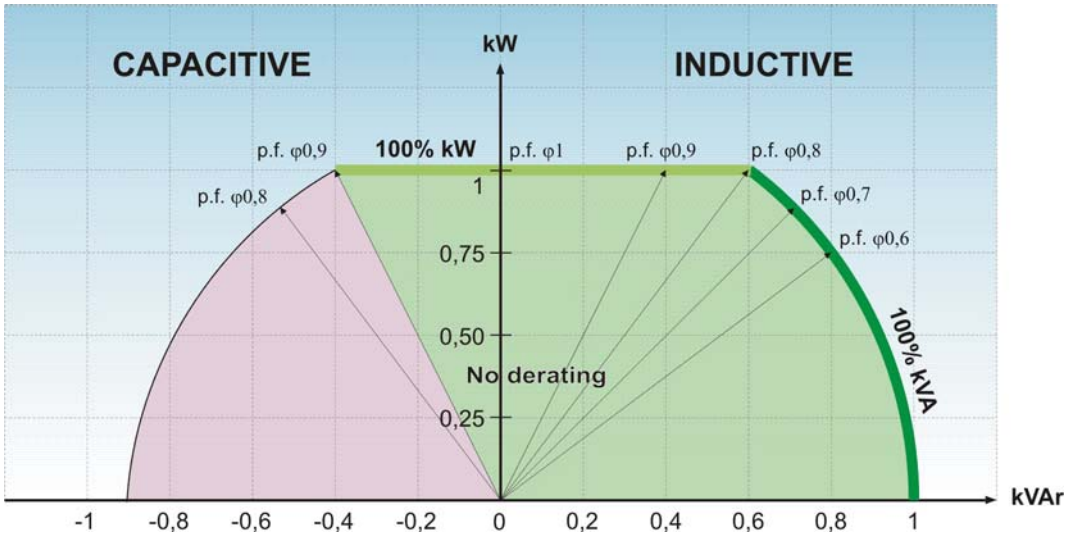
2.2 INVERTER

The inverter converts the DC input voltage to AC voltage, stabilized in frequency and RMS value.
The DC voltage is converted by the IGBT bridge, that uses six switches, controlled using PWM (Pulse Width Modulation) technology at high commutation frequency. The PWM generation as well as the control of the operating variables is completely managed by the microprocessor.
The DC current transducer CT provides for the monitoring of the inverter input current. Its feedback signal is managed by the microprocessor to activate the output short circuit current limitation (see 2.2.3) and the IGBT protection (see 2.2.4).



Picture 4 – Inverter

The output transformer provides the galvanic insulation between DC and AC side, as well as voltage adaptation. Its integrated inductance forms, together with the AC capacitors, a low-pass filter that provides to eliminate the high frequency ripple and keep the total harmonic distortion of the inverter waveform (THD) lower than 2% (with linear load).
The inverter, thanks to its manufacturing technology and to the microprocessor control, is able to supply indifferently inductive or capacitive loads. The maximum apparent power varies slightly in case the load is highly capacitive (p.f. < 0,9) and a de-rating factor, according to the picture 5, must be applied. The data “100% kW” indicates the maximum active power that the UPS can supply to a resistive load (ex: for a 100kVA UPS Pmax=80kW). The table that follows the diagram shows an example of calculation for a 60kVA UPS.



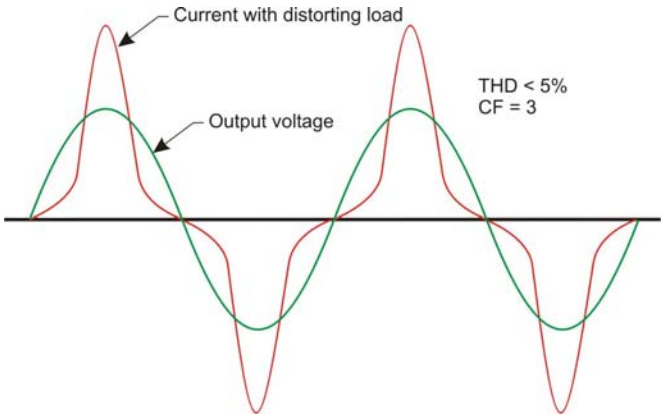
Picture 5 – Diagram of the power

Example: UPS 60kVA Pmax = 48kW

	cos φ (capacitive)					**cos φ (inductive)**		
	0,6	*0,7*	*0,8*	*0,9*	*1*	*0,8*	*0,7*	*0,6*
P / Pmax				1	1	1	0,875	0,75
Max active power (kW)	32	37,3	42,6	48	48	48	42	36
Reactive power (kVar)	42,6	38	32	23	-	36	42,8	48
Apparent power (kVA)	**53,3**	**53,3**	**53,3**	**53,3**	-	**60**	**60**	**60**

2.2.1 Operation with non-linear load

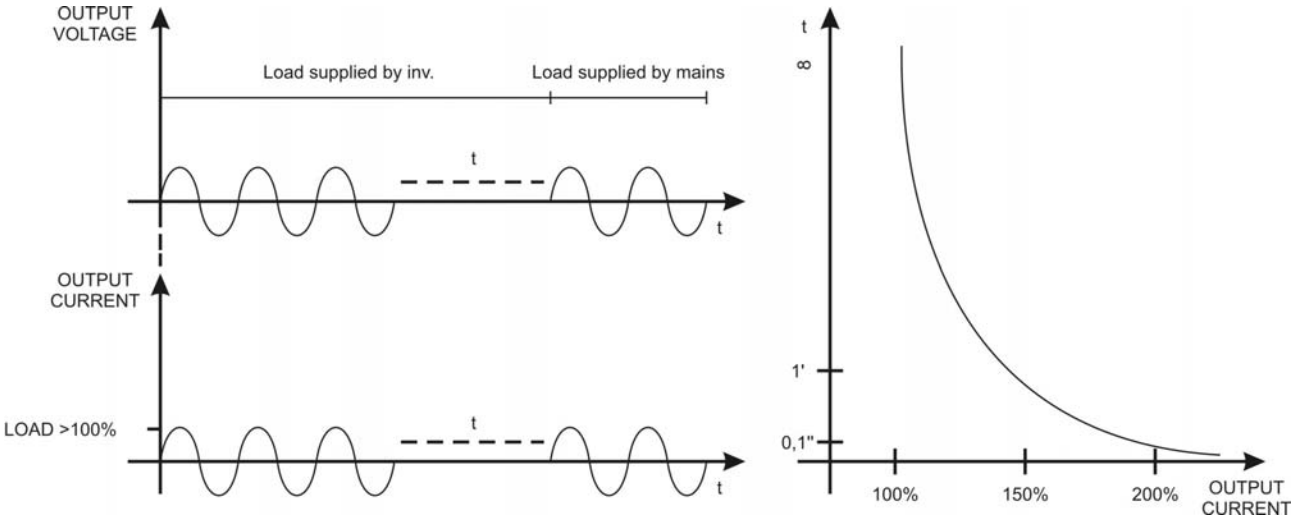
A non-linear load is characterized by a high peak current versus its RMS value, that in normal condition would introduce a distortion on the output waveform.
The inverter is provided with an instantaneous voltage correction facility, completely managed by the microprocessor, that provides to vary the PWM generation according to the actual output waveform, in order to keep the THD within 5% even with loads having crest factor equal to 3.



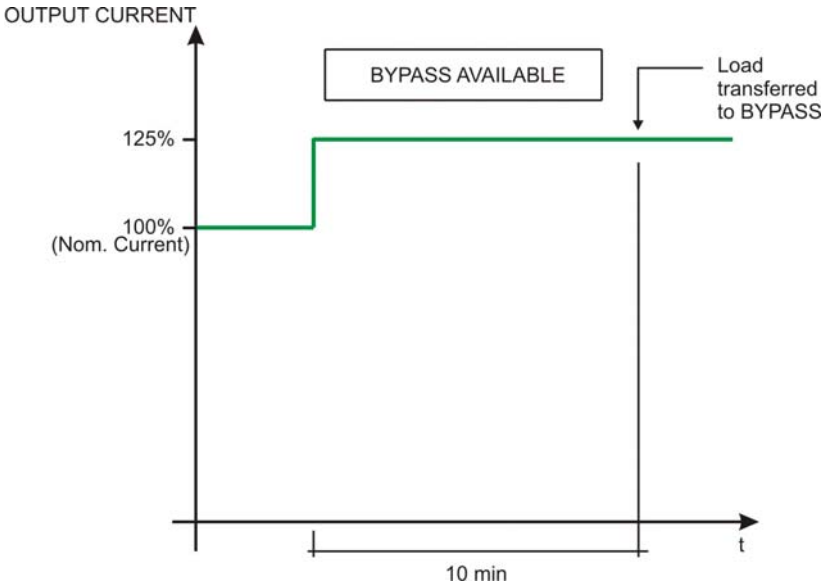
Picture 6 – Operation with non-linear load

2.2.2 Overload management

Inverter can provide continuously 100% of nominal load and can tolerate overload conditions up to 125% for 10 minutes or 150% for 1 minute.
Peak conditions such as take-off of engines or magnetic parts are managed limiting the output current to 200% for 5 cycles, than reducing to 125%.
Any times output power grows above 100% the inverter keeps feeding the loads, while the microprocessor activates the “thermal image” algorithm (technical figure) to calculate thermal image based on output current and duration of the overload in function of the time.
User loads are powered by inverter output up to the end of maximum allowed time, then the static bypass switches to emergency line without interruption of output power.



Picture 7 – Thermal image characteristic



Picture 8 – Overload with bypass available

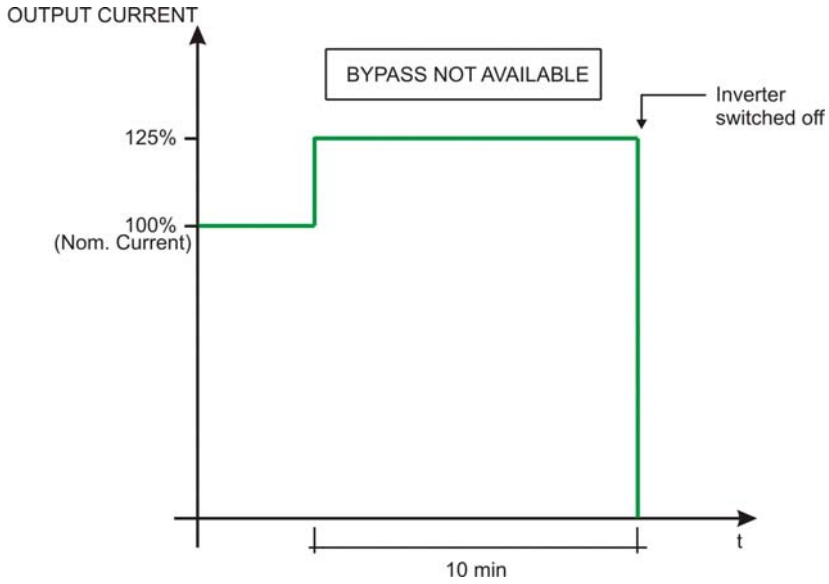
1) BYPASS AVAILABLE

As soon as an overload is detected the algorithm starts to calculate the increment of the energy.

When the limit is reached the load is transferred to bypass.

To allow a safe cooling of the inverter power components (IGBT's, transformer) the inverter is switched off for **30 minutes**.

When this time has elapsed the inverter is switched on again and the load transferred back to the primary supply.



Picture 9 – Overload with bypass not available

2) BYPASS NOT AVAILABLE

As soon as an overload is detected the algorithm starts to calculate the increment of the energy.

When the limit is reached the inverter is switched off to avoid severe damages to the power components.

As soon as the bypass is available again the load is supplied by the bypass static switch.

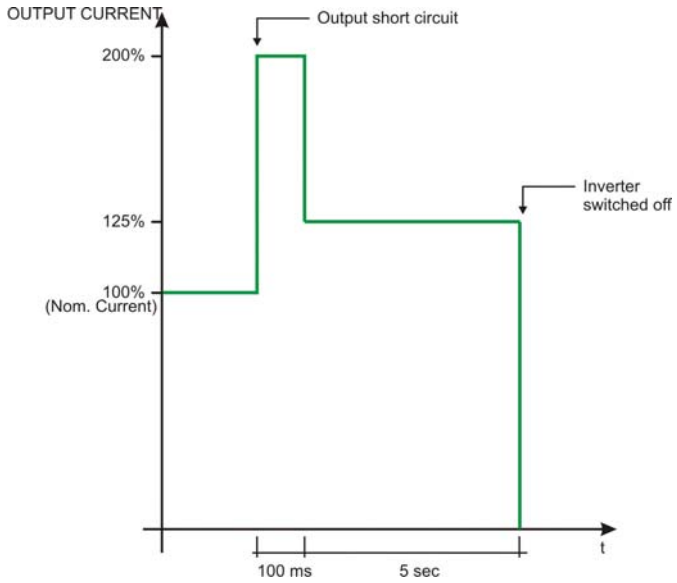
After **30 minutes** the inverter is switched on again and the load re-supplied.

WARNING: this operation causes the loss of the supply to the load

2.2.3 Short circuit operation

As soon as an output short circuit is detected (alarm A25) the load is transferred immediately to the emergency line that provides to eliminate the fault thanks to its higher short circuit current.

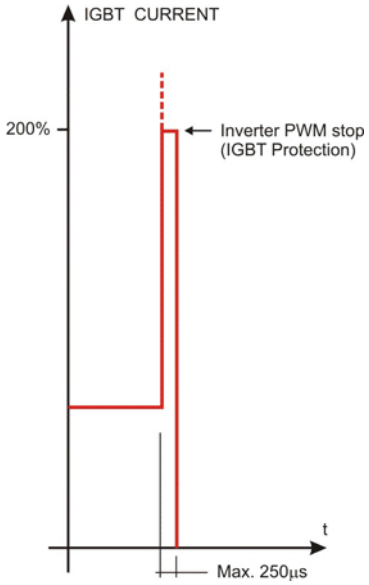
In case the bypass is not available the inverter reduces its output voltage and limits its output current to 200% for 100ms, and then to 125% for 5 seconds, after that it's switched off (according to EN 62040-3 / EN 50091-3).



Picture 10 – Short circuit characteristic (By-pass not available)

2.2.4 IGBT bridge protection

The inverter current monitoring is carried out by the DC current transducer connected upstream the inverter bridge. Therefore the control logic is able to distinguish an output short circuit from an IGBT short circuit.
The behaviour of the inverter in case of short circuit on the load has been described at 2.2.3; the output current is limited and the IGBT bridge current doesn't reach the protection threshold.
In case of short circuit in the inverter bridge the DC input current increases immediately and there's no possibility of limitation but stopping the PWM.
In this case the alarm A24 – Current stop is activated and must be reset manually after having verified the status of the semiconductors.



Picture 11 – IGBT bridge protection

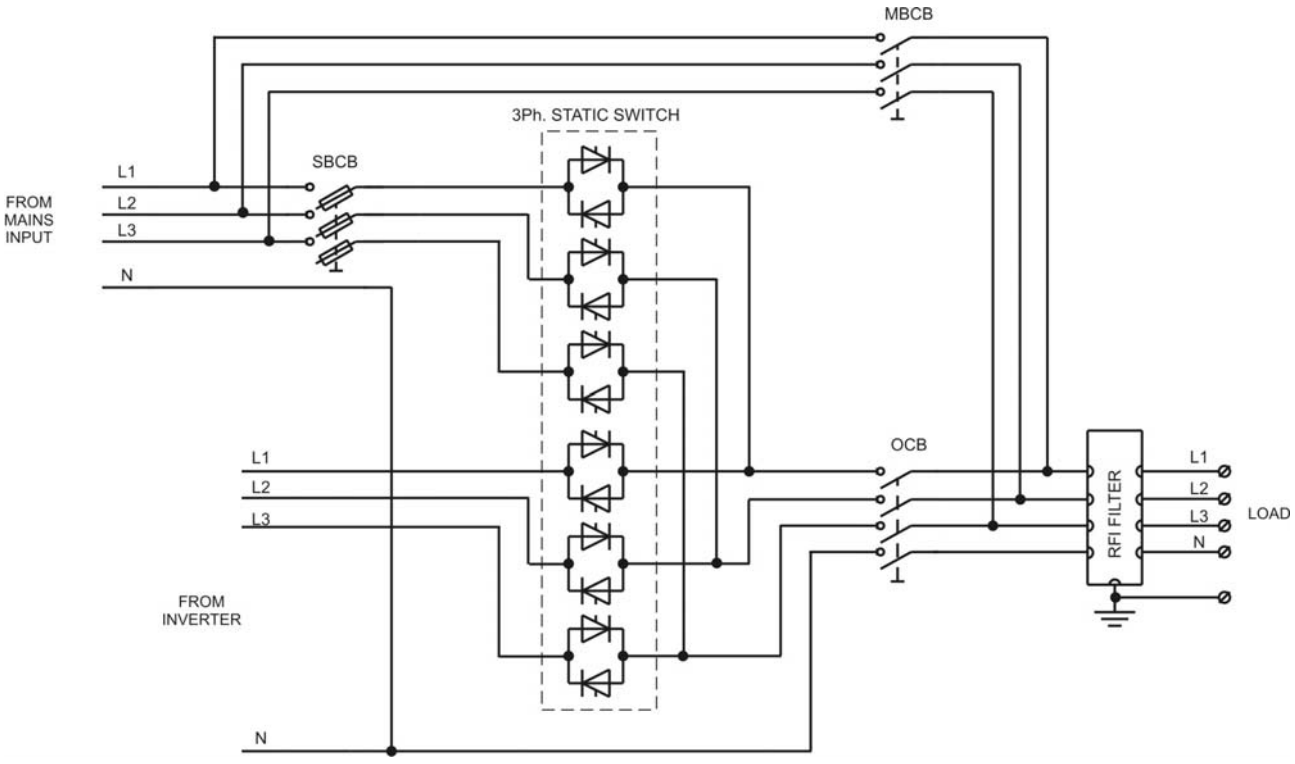
2.3 BATTERY

On the HALLEY/E 20-30kVA UPS, the battery can be installed inside the UPS for autonomy from 5 up to 15 minutes depending on the UPS power (see following table); if the requested back-up time is longer the battery is installed inside external cabinets. On the HALLEY/E 40÷80kVA UPS the battery is always installed in external cabinets.
The battery charger control logic is completely integrated inside the total-controlled rectifier control board; the battery is charged, according to the DIN 41773 Standard, every time it has been partially or completely discharged and it is kept floating, even when it's charged, to compensate any auto-discharge.

UPS	BATTERIES	
	QUANTITY	TYPE
20 kVA – 5 minutes	32	12 Ah
30 kVA – 5 minutes	64	7 Ah
20 kVA – 10 minutes	64	7 Ah
30 kVA – 10 minutes	32	24 Ah
20 kVA – 15 minutes	32	18 Ah

2.4 STATIC SWITCH

Static switch is based on power semiconductor (thyristors), rated to work continuously at 150% of nominal output power.
The thyristors connected to the main power are protected by fuse. On the HALLEY/E 40÷80kVA UPS the fuses are installed inside the switch SBCB.



Picture 12 – Static switch and Manual by-pass

Thanks to the transfer logic integrated in the control, the load is supplied by the bypass static switch even in case of microprocessor failure.

Overload capability: 150% continuously
200% for 1 minute
2000% for 1 cycle

2.4.1 Inverter → Emergency Line transfer

The transfer is activated only if emergency line is in tolerance (in less than 0,5 ms), for the following reasons:

CAUSES	***COMMUTATION CONDITIONS***
Output short circuit	Emergency line within tolerance limits
Fault of inverter or inverter voltage out of tolerance	Emergency line within tolerance limits
DC over-voltage/under-voltage (Inverter OFF)	Emergency line within tolerance limits
Over-temperature	Emergency line within tolerance limits
Thermal image shut down	Emergency line within tolerance limits
Forced commutation by "BYPASS SWITCH" (test or service)	Emergency line within tolerance limits AND synchronized inverter

2.4.2 Emergency Line → Inverter transfer

As soon as inverter is correctly working and synchronized, UPS automatically switches to inverter in less than 1 msec. If UPS switches back and forth more than 6 times in two minutes, an alarm will be generate, to inform the user, and UPS will be locked to emergency line until a manual reset will clear the faulty condition.

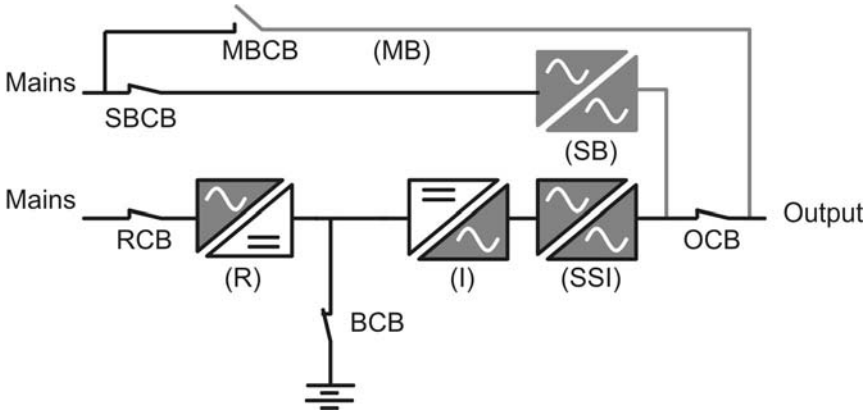
2.5 MANUAL BY-PASS

To safely allow maintenance and repair of the unit, UPS is provided with a manual bypass switch.
In bypass mode all the repairing and testing activities to verify the efficiency of the whole UPS can be carried out safely. Manual by-pass can be inserted by following the relevant instructions. During manual by-pass operation there's no interruption of the supply to the load.

3 OPERATING MODES

3.1 NORMAL OPERATION

During normal operation all the circuit breakers/switches are closed except MBCB (maintenance bypass).
The three-phase input AC voltage feeds the rectifier via the filter inductor; the rectifier supplies the inverter and compensate mains voltage fluctuations as well as load variation, maintaining the DC voltage constant. At the same time it provides to keep the battery in stand-by (floating charge or boost charge depending on the type of battery).
The inverter converts the DC voltage into an AC sine-wave, stabilized in voltage and frequency, and provides to supply the load through its static switch SSI.

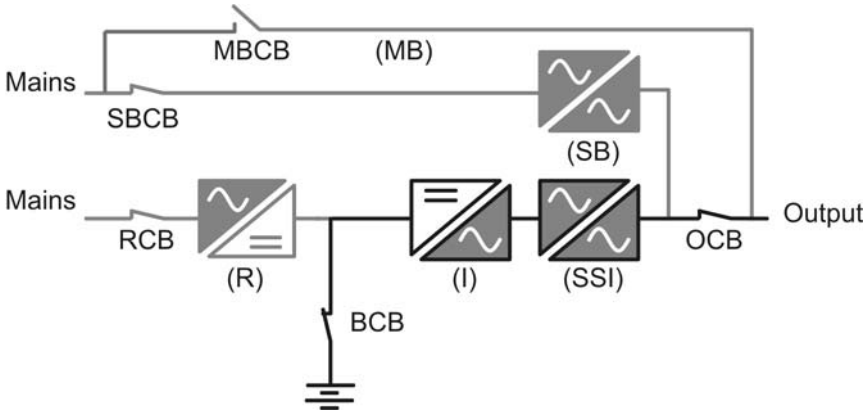


Picture 13 – Normal Operation

Section	Status	Further explanation
Rectifier Mains	available	and within the tolerance range
RCB	CLOSED	
Rectifier	ON	
Battery	available	and within the tolerance range
BCB	CLOSED	
Inverter	ON	
Bypass Mains	available	and within the tolerance range
BYPASS SWITCH	“NORMAL”	
SBCB	CLOSED	
Static Switch SSI	ON	
Static Switch SB	OFF	
OCB	CLOSED	
MBCB	OPEN	
Output Voltage	available	and within the tolerance range

3.2 BATTERY OPERATION

In the event of mains failure, or rectifier failure, the inverter is no longer supplied by the rectifier, so the battery, that is connected to the DC intermediate circuit, is called up immediately and without interruption to supply the load. The battery voltage drops as a function of the magnitude of the discharge current. The voltage drops has no effect on the inverter output voltage since it is kept constant by varying the PWM modulation.
As the battery approaches the discharge limit an alarm is activated. In case the power is restored (even using a diesel generator) before the limit is reached the system switches automatically back to normal operation, if not, the inverter shuts down and the load is transferred to the bypass (bypass operation). If the bypass mains is not available or outside the tolerance range the complete system shuts down as soon as the lowest battery level is reached.
As soon as the power is restored the rectifier charges the battery, and, depending on the depth of the discharge, the charging current is limited by means of the battery current limitation.

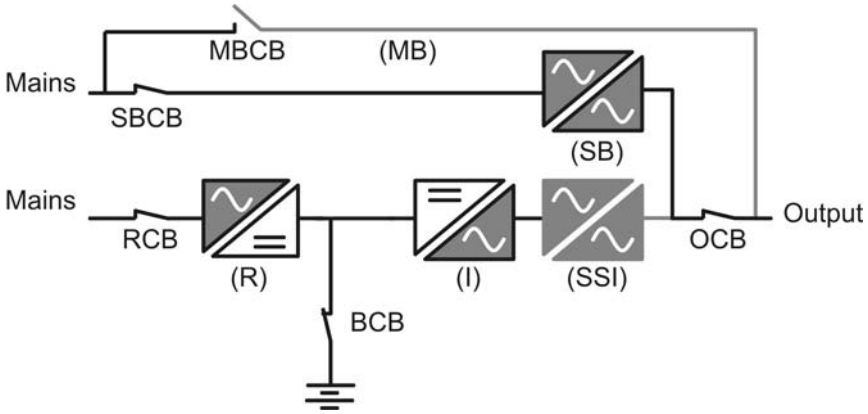


Picture 14 – Battery operation

Section	Status	Further explanation
Rectifier Mains	NOT available	or outside the tolerance range
RCB	CLOSED	
Rectifier	OFF	
Battery	available	and within the tolerance range
BCB	CLOSED	
Inverter	ON	
Bypass Mains	available	and within the tolerance range (may be outside the tolerance range)
SBCB	CLOSED	
BYPASS SWITCH	“NORMAL”	
Static Switch SSI	ON	
Static Switch SB	OFF	
OCB	CLOSED	
MBCB	OPEN	
Output Voltage	available	and within the tolerance range

3.3 BYPASS OPERATION

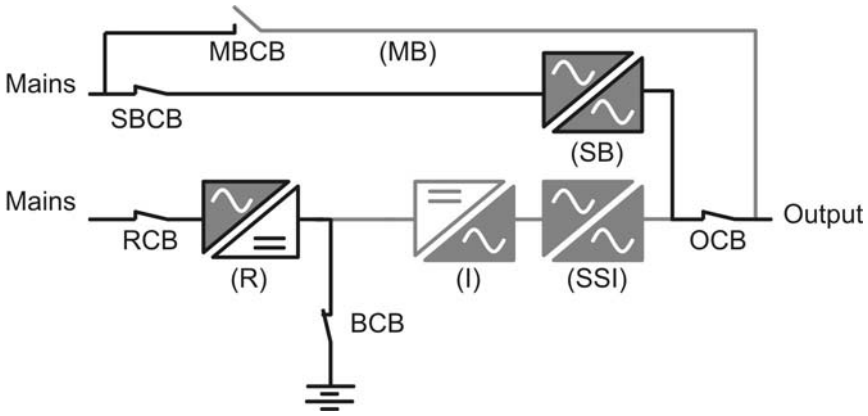
Bypass operation may occur for both manual or automatic change-over. The manual transfer is due to the BYPASS SWITCH, that forces the load to bypass. In the event of a bypass failure the load is transferred back to inverter without interruption.



Picture 15 – Bypass operation (manual change-over)

Section	Status	Further explanation
Rectifier Mains	available	and within the tolerance range (may be outside the tolerance range)
RCB	CLOSED	
Rectifier	OFF / ON	
Battery	available	and within the tolerance range
BCB	CLOSED	
Inverter	ON	
Bypass Mains	available	and within the tolerance range
BYPASS SWITCH	“BYPASS”	
SBCB	CLOSED	
Static Switch SSI	OFF	
Static Switch SB	ON	
OCB	CLOSED	
MBCB	OPEN	
Output Voltage	available	and within the tolerance range

The automatic change-over occurs for the reasons explained in the UPS technical description (see paragraph 2.4.1); basically when the power supply to the load within the specified tolerance cannot be assured by the inverter.

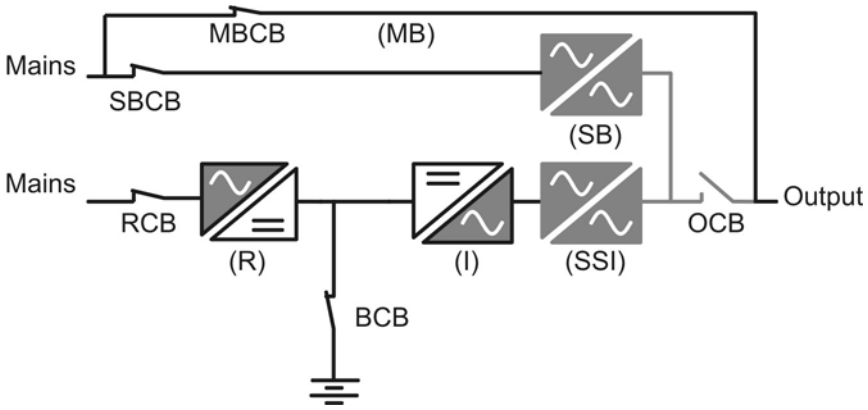


Picture 16 – Bypass operation (automatic change-over)

Section	**Status**	**Further explanation**
Rectifier Mains	NOT available	or outside the tolerance range (may be within the tolerance range)
RCB	CLOSED	
Rectifier	OFF / ON	(depending on the reason of the transfer)
Battery	NOT available	or outside the tolerance range (may be within the tolerance range)
BCB	CLOSED	
Inverter	OFF / ON	(depending on the reason of the transfer)
Bypass Mains	available	and within the tolerance range
BYPASS SWITCH	“NORMAL”	
SBCB	CLOSED	
Static Switch SSI	OFF	
Static Switch SB	ON	
OCB	CLOSED	
MBCB	OPEN	
Output Voltage	available	and within the tolerance range

3.4 MANUAL BYPASS

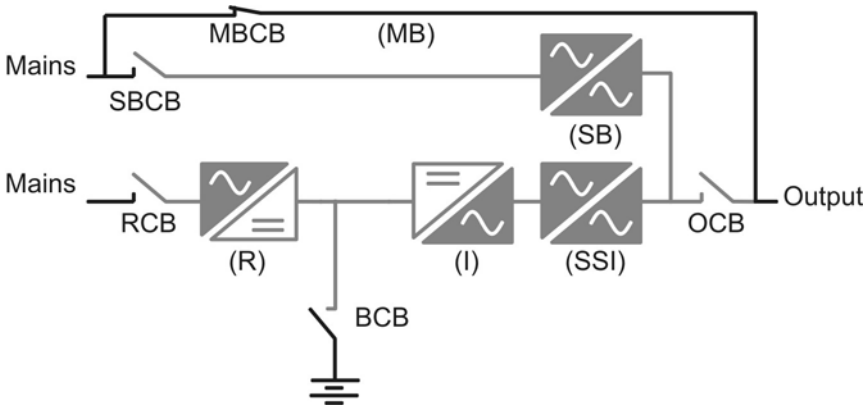
The manual bypass operation is necessary every time the functionality of the UPS needs to be checked or during maintenance or repair works.
The manual bypass procedure is described in the UPS operating manual and must be followed carefully in order to avoid damages to the UPS.
During the functional check of the UPS, all the breakers can be closed, except for the output breaker OCB, and the full functionality can be tested.



Picture 17 – Manual Bypass for functional tests

Section	Status	Further explanation
Rectifier Mains	available	and within the tolerance range (may be outside the tolerance range)
RCB	CLOSED	
Rectifier	ON / OFF	(depending on the tests needed)
Battery	available	
BCB	OPEN / CLOSED	(depending on the tests needed)
Inverter	ON / OFF	(depending on the tests needed)
Bypass Mains	available	and within the tolerance range
BYPASS SWITCH	“NORMAL /BYPASS”	(depending on the tests needed)
SBCB	OPEN / CLOSED	
Static Switch SSI	ON / OFF	(depending on the tests needed)
Static Switch SB	ON / OFF	(depending on the tests needed)
OCB	OPEN	
MBCB	CLOSED	
Output Voltage	available	supplied directly by the bypass mains

During the manual bypass operation for repair or maintenance, the UPS is completely switched off and the load is supplied directly by the bypass mains.

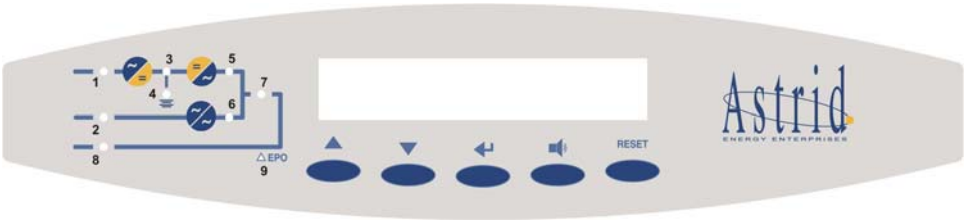


Picture 18 – Manual Bypass for repair or maintenance works

Section	**Status**	**Further explanation**
Rectifier Mains	available	and within the tolerance range (may be outside the tolerance range)
RCB	OPEN	
Rectifier	OFF	
Battery	available	
BCB	OPEN	
Inverter	OFF	
Bypass Mains	available	and within the tolerance range
BYPASS SWITCH	“BYPASS”	
SBCB	OPEN	
Static Switch SSI	OFF	
Static Switch SB	OFF	
OCB	OPEN	
MBCB	CLOSED	
Output Voltage	available	supplied directly by the bypass mains

4 USER INTERFACE (FRONT PANEL)

The front panel of the UPS, consisting of a double row alphanumeric display plus 5 function keys, allows the complete monitoring of the UPS status.
The mimic flow helps to understand the operating status of the UPS.



Picture 19 – Front panel

Picture 19 shows the mimic present on the display, with the names of the circuit breakers/isolator switches of the UPS. Also the led's and blocks that comprise the UPS are clearly identified.

LED 1 ⇒ Lit-up green = Mains present at the rectifier input. Otherwise off.

LED 2 ⇒ Lit-up green = Emergency line present and phase sequence correct.
Otherwise off.

LED 3 ⇒ Lit-up green = Rectifier feeding correctly.
Lit-up red = Rectifier output voltage out of tolerance.

LED 4 ⇒ Lit-up green = Battery OK.
Green flashing = Battery discharging or battery in test.
Orange flashing = BCB open.
Lit-up red = Battery test aborted.

LED 5 ⇒ Lit-up green = Inverter static switch closed.
Green flashing = Inverter output voltage out of tolerance
Otherwise off.

LED 6 ⇒ Lit-up orange = Emergency line static switch closed.
Otherwise off.

LED 7 ⇒ Lit-up green = Voltage present on the load.
Lit-up orange = OCB circuit breaker open.

LED 8 ⇒ Lit-up orange = Manual by-pass closed. Otherwise off.

LED 9 ⇒ Lit-up red = EPO push-button pressed

4.1 ALARMS AND OPERATING STATUS

The alphanumeric display offers a complete diagnostic of the system by showing 25 alarms and 6 operating status descriptions. Each alarm is associated with an internal protection, controlled by the microprocessor, that disables certain UPS functions in order to avoid possible load breaks.
Each alarm and status is associated to a code; the alarm codes are stored in the events history.
The display management for the alarms and status, including the history log, is described in the section 4.3.4.

4.1.1 Alarms

Code	ALARM NAME		Description
A1	**MAINS FAULT**	=	Rectifier input mains failure
A2	**CHARGER FAULT**	=	Battery charger failure
A3	**RECT FUSE**	=	One or more rectifier fuses are blown
A4	**THER IMAGE**	=	Load transferred to mains due to overload. After 30' the load is transferred back to inverter
A5	**AC/DC FAULT**	=	Rectifier output voltage out of tolerance
A6	**INPUT WR SEQ**	=	Input phase rotation not correct
A7	**BCB OPEN**	=	Battery circuit breaker open
A8	**BATT DISCH**	=	The battery is discharging
A9	**BATT AUT END**	=	Battery autonomy (calculated) has expired
A10	**BATT FAULT**	=	Battery test failed or intervention of the safety timer during boost charge
A11	**BATT IN TEST**	=	Battery test in progress
A12	**PLL FAULT**	=	Problems with the digital synchronisation system
A13	**INV OUT TOL**	=	Inverter output voltage out of tolerance
A14	**OVERLOAD**	=	Inverter overload (load exceeding 100%). The thermal image protection is started
A15	**BYP FAULT**	=	Emergency mains not available
A16	**BYP FEED LOAD**	=	Load fed by bypass
A17	**RETR BLOCK**	=	Re-transfer between bypass and inverter blocked
A18	**MBYP CLOSE**	=	Manual bypass breaker closed (inverter shutdown)
A19	**OCB OPEN**	=	UPS output breaker open
A20	**FANS FAILURE**	=	Optional
A21	**HIGH TEMP**	=	High temperature on the inverter and/or rectifier bridge
A22	**BYP SWITCH**	=	Closure of the commutation switch which forces the load to bypass (maintenance)
A23	**EPO BUS**	=	Intervention of the emergency power off switch according to the EN62040-1
A24	**CURR STOP**	=	Inverter bridge stop for max current
A25	**SHORT CIRC**	=	Intervention of the short circuit protection (current exceeding 200%)

4.1.2 Status

Code	STATUS NAME		Description
S1	**AC/DC OK**	=	Rectifier output voltage in tolerance
S2	**BATTERY OK**	=	Battery connected to the DC bus
S3	**INVERTER OK**	=	Inverter output voltage in tolerance
S4	**INVERTER SYNC**	=	Inverter synchronization reference in tolerance
S5	**INV FEED LOAD**	=	Inverter static switch closed, load fed by inverter
S6	**BYPASS OK**	=	Bypass voltage and frequency in tolerance

4.1.3 Protections

Code	ALARM NAME		Type of protection
A1	**MAINS FAULT**	=	The rectifier is switched off. The inverter is supplied by the battery, provided the alarm A7 is not active (battery breaker open).
A2	**CHARGER FAULT**	=	The rectifier is switched off. The inverter is supplied by the battery, provided the alarm A7 is not active (battery breaker open).
A3	**RECT FUSE**	=	The rectifier is switched off. The inverter is supplied by the battery, provided the alarm A7 is not active (battery breaker open).
A4	**THER IMAGE**	=	The load is transferred to bypass for 30 minutes to allow a safe cooling of the inverter bridge.
A5	**AC/DC FAULT**	=	The inverter is switched off and the load is transferred to bypass.
A6	**INPUT WR SEQ**	=	The rectifier is switched off. The inverter is supplied by the battery, provided the alarm A7 is not active (battery breaker open).
A13	**INV OUT TOL**	=	The load is transferred to bypass until the inverter output voltage is in tolerance again.
A14	**OVERLOAD**	=	The thermal image protection is started (see alarm A4).
A15	**BYP FAULT**	=	The inverter feeds the load. Transfer to bypass, even manually, is disabled.
A17	**RETR BLOCK**	=	Load fed by bypass. This condition can be reset entering the SPECIAL menu.
A18	**MBYP CLOSE**	=	The inverter is switched off to avoid parallel with the mains.
A21	**HIGH TEMP**	=	The inverter is switched off to avoid overheating of the components. The load is transferred to bypass.
A24	**CURR STOP**	=	The inverter is switched off and the load transferred to bypass.
A25	**SHORT CIRC**	=	The load is transferred to bypass, if available, otherwise the inverter limits the short circuit current to 200% of the nominal current

4.2 MEASUREMENTS ON THE DISPLAY

The measures shown on the display are listed below. The display management for the measures, is described in the section 4.3.3.

OUTPUT		Description
OUTPUT VOLTAGE	=	RMS value of the UPS output voltage
OUTPUT FREQUENCY	=	Value, in Hertz, of the frequency of the output voltage
OUTPUT CURRENT	=	RMS value of the output current
LOAD %	=	Percentage of load calculate with reference to the rated load in kVA

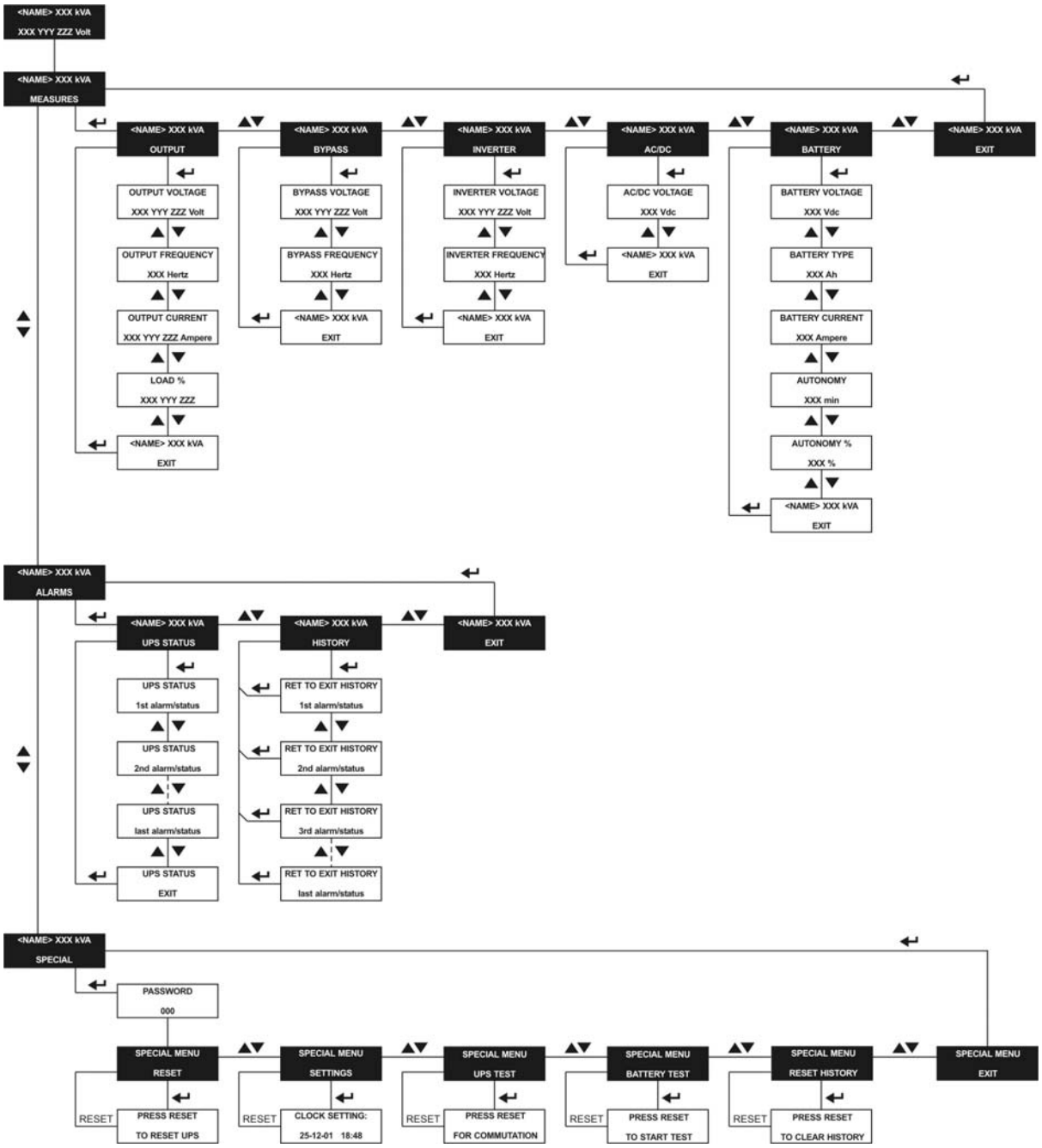
BYPASS		Description
BYPASS VOLTAGE	=	RMS value of the bypass input voltage
BYPASS FREQUENCY	=	Value, in Hertz, of the frequency of the bypass voltage

INVERTER		Description
INVERTER VOLTAGE	=	RMS value of the inverter output voltage (measured upstream the inverter static switch)
INVERTER FREQUENCY	=	Value, in Hertz, of the frequency of the inverter voltage

AC/DC		Description
AC/DC VOLTAGE	=	RMS value of the rectifier output voltage (DC bus)

BATTERY		Description
BATTERY VOLTAGE	=	RMS value of the battery voltage
BATTERY TYPE	=	Value, in Ah, of the battery nominal capacity
BATTERY CURRENT	=	Battery current during discharge mode
BATTERY AUTONOMY	=	Value, in minutes, of the calculated autonomy time
BATTERY AUTONOMY %	=	Value, in %, of the calculated autonomy (remaining capacity)

4.3 MENU STRUCTURE



Picture 20 – Menu structure

5 GENERAL TECHNICAL DATA

5.1 TECHNICAL DATA SHEETS

5.1.1 GENERAL INFORMATION

UPS POWER (kVA)		**20**	**30**	**40**	**60**	**80**
UPS typology		ON LINE – Double Conversion				
Nominal output power @ P.F. 0,8	(kVA)	20	30	40	60	80
Nominal output power @ P.F. 1	(KW)	16	24	32	48	64
Efficiency AC ÷ AC	(%)	>90	>90	>90	>90	>90
Heat dissipation at nominal load and voltage:	-KW -Kcal	1,78 1531	2,67 2296	3,55 3053	5,33 4584	7,11 6115
UPS ambient temperature	(°C)	0÷40				
BATTERY ambient temperature	(°C)	0 ÷ +25				
UPS storage temperature	(°C)	-10 ÷ +70				
BATTERY storage temperature	(°C)	-10 ÷ +60				
Relative humidity non condensing	(%)	<95				
Altitude	(mt)	<1000 (Above Sea Level)				
Power de-rating for altitude > 1000mt		According “EN62040-3”				
Ventilation		FORCED				
Requested cooling air volume	(mt3/h)	700	800	1200	1500	2100
Audible noise level (according EN 50091)		<58dB		<60dB		
Standard battery type lead acid	(N° cells)	192				
Storage time of battery without recharge	(at 25°C)	3 months				
Protection degree		IP 20				
EMC Compatibility		According “EN 50091-2”				
Paint		RAL 5026 Met. RAL 9006 Met.				
Accessibility		Front and top access for service				
Static load without battery	(Kg/m2)	610	628	730	844	958
Input/output cable connection		Bottom side				
Transport		Base provided for forklift handling				
Transport mechanical stress		According “EN62040-1”				
Design standard		According “EN62040-1”				
Free contact interface		On request				
Serial communication interface		RS232-RS485				
Parallel configuration		To increase output power up to 4 UPS or 3+1 redundant				

5.1.2 RECTIFIER

UPS POWER (kVA)		**20**	**30**	**40**	**60**	**80**
Nominal Input Voltage	(Vac)	380÷415 +/- 10% (Selectable)				
Input Frequency	(Hz)	50-60 +/- 5%				
Input Power Factor (@ 380Vac)		>0,8				
DC Voltage Accuracy	(%)	+/- 1				
DC Voltage Ripple (With battery connected)	(% rms)	<2				
THD rejected into the mains	(%)	<32				
Battery Recharging Characteristic		IU (DIN 41773)				
Temperature Battery Voltage Compensation		On Request				
Maximum Battery Recharging Current (@ nominal load)	(A)	10	10	15	20	20
Rectifier Bridge Type		Three Phase Full bridge rectifier				
Input protection		Fast fuses				
Nominal Current Absorbed from Mains (@ nominal load and Battery in floating)	(A)	34	50	66	100	133
Maximum Current Absorbed from Mains (@ nominal load and max. recharging current)	(A)	42	60	79	116	149

5.1.3 INVERTER

UPS POWER (kVA)		**20**	**30**	**40**	**60**	**80**
Inverter Bridge		IGBT (High Frequency Comm.)				
Nominal Output Power @ P.F. 0,8	(kVA)	20	30	40	60	80
Nominal Output Power @ P.F. 1	(KW)	16	24	32	48	64
Nominal Output Voltage	(Vca)	380÷415 (Selectable)				
Output Voltage Stability - Static - Dynamic (Step Load 0÷100%÷0) - Output Volt. Recovery Time (after load step)	(%)	 +/- 1 +/- 8 Within 40 ms				
Output Frequency	(Hz)	50-60 (Selectable)				
Output Frequency Stability - Free Running Quartz Oscillator - Inverter Synchronized with Mains	(Hz)	 +/- 0,001 +/- 2 (Adjustable)				
Nominal Output Current - @ P.F. 0,8 - @ P.F. 1	(A)	 29 23	 43 35	 37 46	 87 55	 116 93
Overload Capability	(%)	125% for 10', 150% for 1' 200% for 100 ms				
Short Circuit Current	(A)	46	70	92	110	186
Short Circuit Characteristic		Elect. short circuit protection, current limited at 2 times nominal current				
Selectivity		Within ½ cycle (fus. gG 20% In)				
Output Waveform		Sinusoidal				
Output Harmonic Distortion - Linear Load - Non Linear Load	(%)	 <2 <5				
Crest Factor		3:1				
Max. DC current absorbed by inverter during battery discharge (@ 320Vdc and nom. load)	(A)	54,5	81,8	107	160	213

5.1.4 STATIC BY-PASS

Automatic Static By-Pass		Electronic Thyristor Switch
Nominal Voltage	(Vac)	380 ÷ 415 (Selectable) +/-10%
Nominal Frequency	(Hz)	50 - 60 (Selectable) +/-5
Transfer Inverter ÷ Static By-Pass		In case of : - Inverter Test - Inverter failure - Inv. input volt. out of limit - Inv. output volt. out of limit
Retransfer Static By-Pass ÷ Inverter		Automatic or Manual (Selectable) Block on mains after 6 commut. in 2 minutes
Overload Capability		- 150% continuously - 200% for 1 minute - 2000% for 1 cycle
Manual By-Pass		With electric security and without interruption

5.2 INSTRUCTIONS FOR INSTALLATION

5.2.1 Receipt of the UPS

When the UPS is received, please attend immediately to its unpacking and carry-out an accurate visual check to be sure that the equipment has not been damaged during transport.

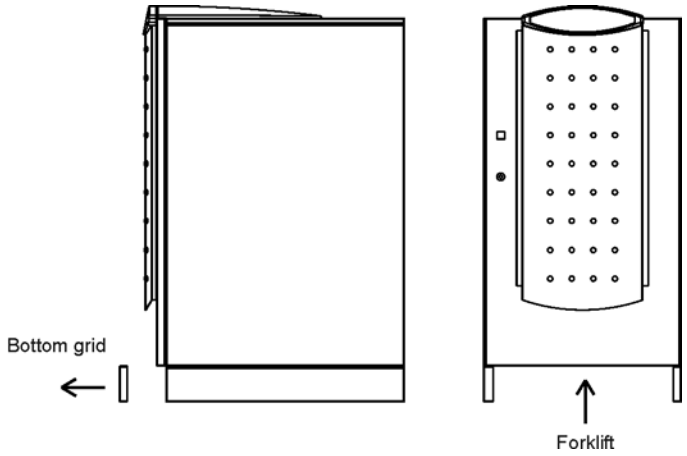
IMPORTANT

In case of objections relating to damage incurred during transport these must be immediately notified to the transportation company after receipt of the equipment.

When the UPS is not installed immediately it must be stored carefully in vertical position, as indicated on the packing and conserved in a dry and sheltered room in its box so that it is protected from dust.

5.2.2 Handling of the UPS

Before positioning the UPS, in order to avoid risks of turnover, it's recommended to move the system on the wood pallet on which the UPS is fixed.
Before the positioning in the final location, remove the UPS from the pallet.
The UPS can be lifted and handled using a pallet truck or a forklift.
The UPS can be handled only after having taken-off (manually), the lower front panel, so that a pallet truck or a forklift can be inserted (see picture 21).
The UPS technical data are shown on a label fixed on the internal side of the front door.

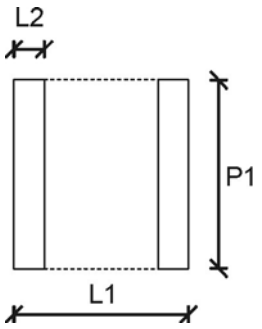


Picture 21 – Handling of the UPS

5.2.3 Positioning and installation

The UPS must be installed in a clean and dry room, preferably not dusty. The User must ensure that there is enough air exchange in the room so that the equipment can be adequately cooled; if this is not guaranteed, the room must be adequately aired.
If the UPS contains the batteries internally the air exchange with the external ambient will have to be according to EN 50091-1, annex N.
The picture 22 and the following tables show the base plan of the UPS with the related dimensions and the weight of the unit with internal batteries.

5.2.3.1 Base plan, static load and weights

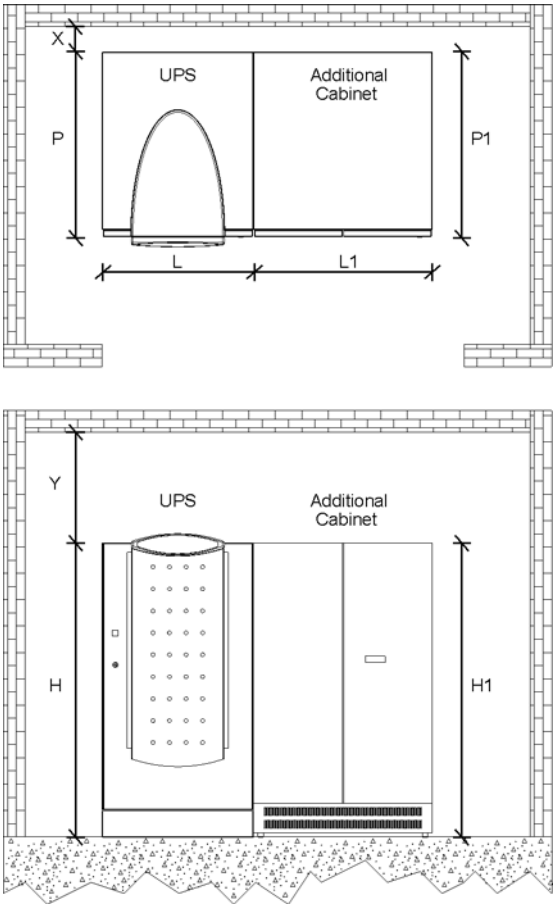


Picture 22 – Base plan

UPS (kVA)	20	30	40	60	80
L1 – mm	650	650	650	650	650
P1 – mm	820	820	820	820	820
L2 – mm	25	25	25	25	25

UPS (kVA)	20	30	40	60	80
Weight w/o battery – kg	325	335	389	450	511
Weight with battery **(5 minutes autonomy)** – kg	481	535	-	-	-
Weight with battery **(10 minutes autonomy)** – kg	495	669	-	-	--
Weight with battery **(15 minutes autonomy)** – kg	549	-	-	-	-

5.2.3.2 Dimensions and distances



Picture 23 – Dimensions and distances from the walls

UPS (kVA)	**20**	**30**	**40**	**60**	**80**
L – mm	690				
P – mm	865				
H – mm	1345				
X (min.) – mm	50				
Y (min.) – mm	500				
ADD. CABINET	**AS028**		**AS029**		
L1 – mm	620		815		
P1 – mm	645		820		
H1 – mm	1150		1340		

The additional cabinets AS028 and AS029 are cabinets for external battery.

5.2.4 Electrical connection

The electrical connection is part of the work which is normally provided by the supplier that carries out the electrical installation and not by the UPS manufacturer. For this reason, the following recommendations are only an indication, as the UPS manufacturer is not responsible for the electrical installation.
In any case we recommend to carry-out the installation and the electrical connections of the input and output in compliance with the local standards.
During the electrical installation take particular care to check the phase rotation using a suitable instrument.
The terminals are positioned at the front of the UPS and they can be accessed by opening the front door.

WARNING

The connection to the mains must be carried out with protection fuses or circuit breakers between the mains and the UPS.

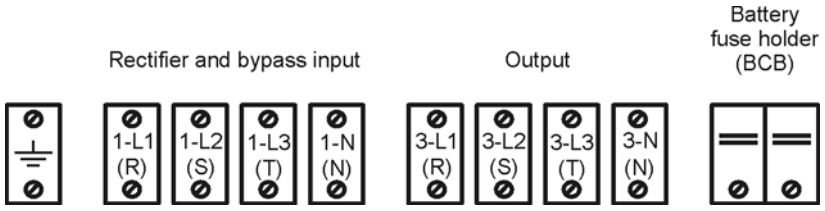
The use of residual current devices in the line supplying the UPS is unadvisable. The leakage current due to the RFI filters is rather high and it can cause spurious tripping of the protection device.

According to the EN62040-1 standard, in order to take into account the UPS' leakage current, residual current devices having adjustable threshold can be used.

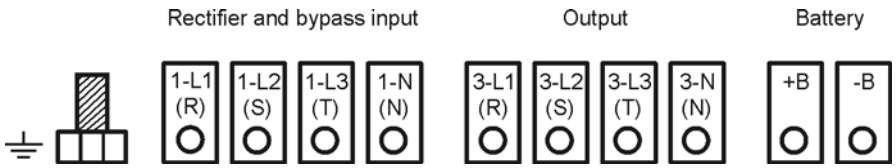
The recommended section of the connection cables is shown in the following tables.

UPS (kVA)		20	30	40	60	80
Input fuses (A)	Rectifier	3x50	3x80	3x150	3x200	3x200
	Bypass	-	-	-	-	-
Input cables (mm^2)	Rectifier	4x10	4x25	4x35	4x50	4x70
	Bypass	-	-	-	-	-
Output cables (mm^2)		4x10	4x25	4x35	4x50	4x70
Battery cables (mm^2)		2x16	2x25	2x50	2x50	2x70

5.2.4.1 Terminal board



Picture 24 – Terminal board UPS 20-30kVA



Picture 25 – Terminal board UPS 40÷80kVA

5.2.5 Battery connection and positioning

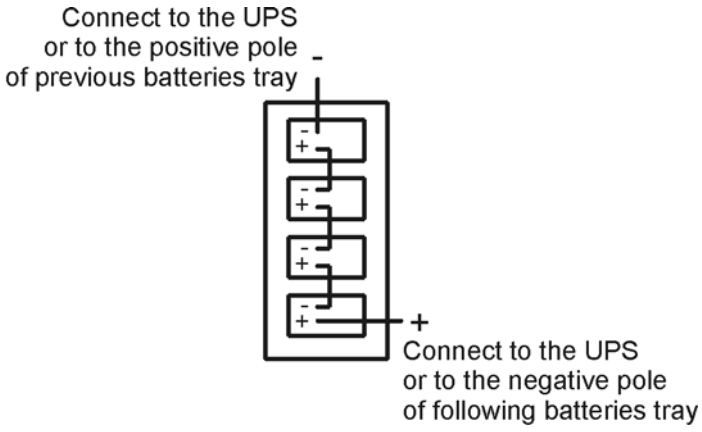
IMPORTANT

For battery installation please respect the EN62040-1-2 prescriptions, paragraph 4.9.20, and at the same time all the national rules or specifications which can be applied to the premises or building.
To obtain the battery life indicated by the battery manufacturer, the operating temperature must remain between 0 and 25 °C. However, although the battery can operate up to 40 °C, there will be a significant reduction of the battery life.
To avoid the formation of any kind of potentially explosive hydrogen and oxygen mixture, suitable ventilation must be provided where the battery are installed (see EN62040-1-2 annex N).
For the materials installed in France, we have to apply the rules according to NFC 15-100 article 554.2: the volume of the renewed air has to be at least 0,005 NI m^3 per hour, where N is the number of the elements inside the battery and I is maximum current of the rectifier.

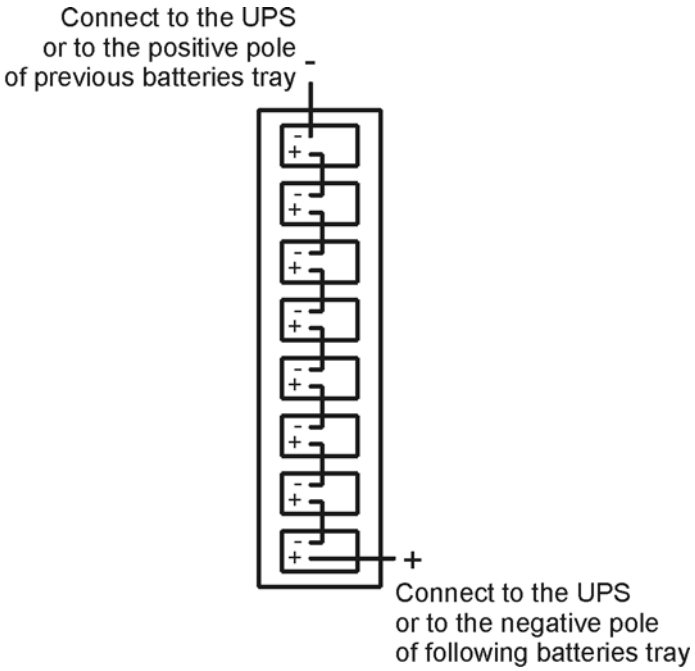
The batteries can be internal or external, however, it is recommended to install them when the UPS is capable of charging them. Please remember that, if the battery is not charged for periods over 2-3 months they can be subject to irreparable damage.
In order to avoid any damage during the transport battery is delivered with some connection cables disconnected (in order to have a battery voltage for each shelf less than 120V) and with protective cardboard.
At the time of the installation you will have to provide to remove the protective cardboard **(as indicated on label MD388070, placed on the protective cardboard)** and to reconnect the cables **(as indicated on label MD388071, placed on the door of the UPS)**.

IMPORTANT

Only the UPS's 20KVA and 30kVA (up to 10' autonomy) have internal batteries. The bigger sizes must be connected with external battery cabinets.



Picture 26 – Wiring 4 batteries for tray



Picture 27 – Wiring 8 batteries for tray

The configurations and the quantity of battery trays mounted on the UPS are shown in the following table:

UPS	BATTERY TRAYS	
	QUANTITY	TYPE
20 kVA – 5 minutes autonomy	04	Pict. 25
30 kVA – 5 minutes autonomy	08	Pict. 25
20 kVA – 10 minutes autonomy	08	Pict. 25
30 kVA – 10 minutes autonomy	08	Pict. 24
20 kVA – 15 minutes autonomy	08	Pict. 24

5.2.6 External battery

The external battery is used to increase the UPS autonomy time during mains failure. It's always provided for UPS having rating >30KVA

IMPORTANT

With an external battery, the internal battery isn't necessary.

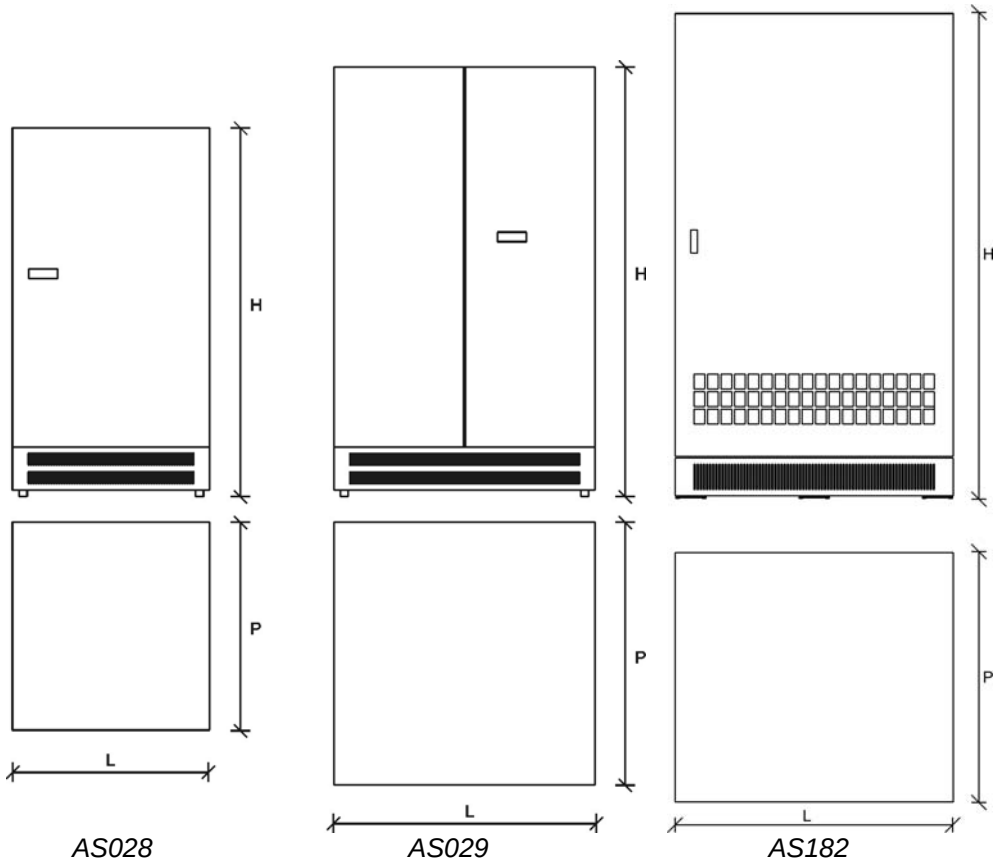
The external battery, (consisting of 32 battery blocks maximum, with 6 cells each for 192 cells total), can be installed in three different cabinets:

- AS028 for 38Ah battery blocks
- AS029 for 65Ah battery blocks
- AS182 for 130Ah battery blocks

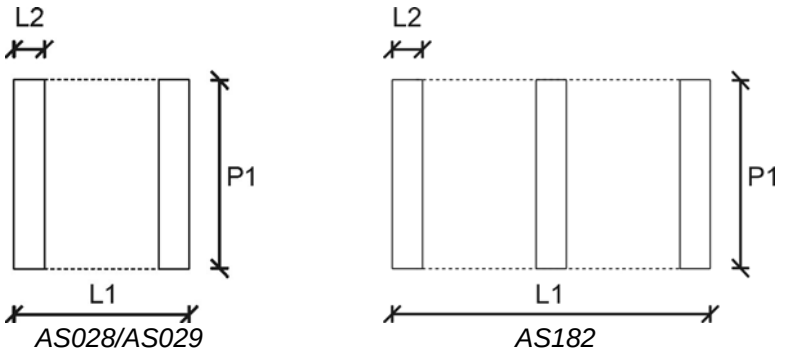
The battery circuit breaker is installed inside the external battery cabinet, so it's not provided in the UPS. Concerning the installation of the external battery cabinet, refer to the details given in paragraph 5.2.5.

The connection cables with the UPS are included inside the battery cabinet (standard length 5m). The standard colour for the external battery cabinet is RAL 5026; the protection level is IP20.

5.2.6.1 Dimensions and weights



Picture 28 – Dimensions of the external battery cabinets



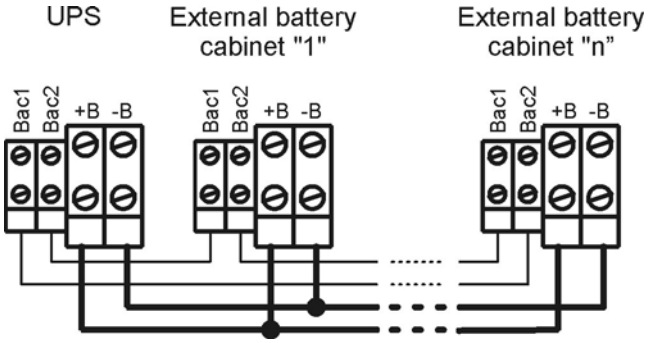
Picture 29 – Base plan of the external battery cabinets

CABINET	AS028	AS029	AS182
L – mm	620	815	1030
P – mm	645	820	925
H – mm	1150	1340	1800
L1 – mm	580	775	1025
P1 – mm	600	775	900
L2 – mm	25	25	112
Weight without battery – kg	100	160	340

CABINET	AS028	AS029	AS182
Numbers of blocks 12V	32	32	32
Dim. Max block (mm)	196x163x185	350x180x190	410x220x280
Max Nominal Capacity per block	38 Ah	65 Ah	130 Ah
Weight of single block	14,6 Kg	24 Kg	45 Kg

5.2.6.2 Connections

The following picture shows the electrical connection between the UPS and the external battery cabinet.



Picture 30 – Battery cabinets connections

The connection cables are two power cables, with section of 50mm^2 and with length ranging from 2 to 50m. Longer cables are subject to excessive voltage drop, so their section must be increased accordingly.

6 OPTIONS

6.1 INSULATION TRANSFORMERS

The additional transformers are used in UPS input and/or output, to adapt the voltage, or to separate the UPS from the mains and/or the load.
They are assembled in external cabinets.

6.1.1 By-pass insulation transformer

It is used when the three phase input mains is without neutral or the galvanic isolation between the mains and the load is required.
During the UPS normal operating condition the inverter transformer provides for this task, while during the bypass condition (for example in case of any overload), the mains feeds the load directly. Generally this configuration is used when the output neutral conductor must be different from the input, thus discriminating two different grounding systems.

6.1.2 Rectifier insulation transformer

It is used when the galvanic isolation between the three-phase mains and the battery is required.

6.1.3 Voltage Adaptation Transformers

A voltage adaptation transformer can be connected at the UPS output terminals to adapt the standard voltage to the value requested by the AC loads. It can also be connected at the input terminals to adapt the actual mains voltage to the UPS specific value (see technical specification). In case the galvanic isolation is not required an auto-transformer can be used.

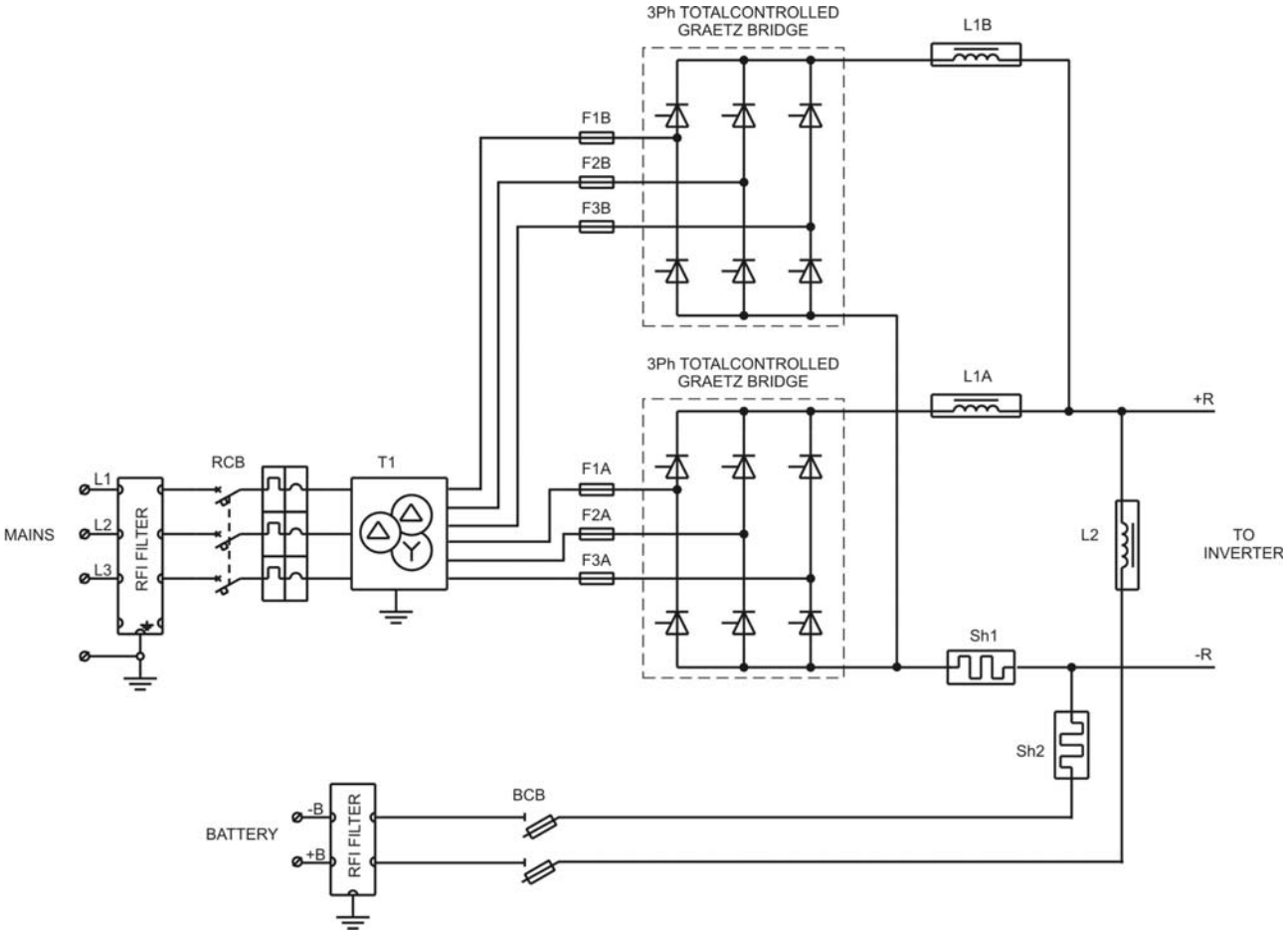
6.2 12-PULSE RECTIFIER

The 12 pulses configuration is used to reduce the distortion of the current absorbed from the mains (THD) to a value lower than 12%.
This ensures that the rectifier does not distort the supply mains, with regard to the other loads; it also avoids the overheating of the cables due to the harmonics circulation.
This technology uses two 6 pulse rectifier bridges, which operates with an input voltage having a phase displacement of 30°; the two DC outputs are connected in parallel through two stabilizing chokes. A DC current transformer provides the feedback signal for the current sharing control. The galvanic isolation between AC and DC side is provided by the input transformer, that is designed with two secondary windings displaced by 30° (delta/delta-star connection). This rectifier can also be designed without galvanic isolation; in this case the phase-shifted rectifier is provided only on one rectifier bridge, while the other is supplied directly by the mains through a three-phase filter inductor.
This configuration allows the system to cancel the typical harmonics of the 6 pulses rectifier, namely the 5^{th} and 7^{th}. As a consequence only the higher order harmonics remain (the 11^{th}, 13^{th} and the multiples). This system is highly recommended for high power equipment, where the current distortion caused by the rectifier might affect other loads connected to the mains. It's also advisable to use 12 pulses rectification in order not to overload an emergency diesel generator supplying the system in case of mains failure.
The typical harmonic content of the current absorbed by a 12P rectifier is shown below.

Harmonic order	1	5	7	11	13	17	19	**THD**
Amplitude (I_n/I_1)	100 %	1,9 %	1,3 %	7,2 %	5,7 %	0,4 %	0,3 %	9,7 %

Therefore the main advantages of the use of a 12 pulses rectifier are:

- Lowest harmonic content of the AC input current
- Lowest ripple on the DC output voltage
- Better operating conditions for the AC supply cables
- Better operating conditions for a possible diesel generator



Picture 31 – Rectifier 12P with galvanic isolation

6.3 IP31 PROTECTION DEGREE

An increased protection degree is available on request instead of the standard IP20. In this case an additional roof is added to guarantee the protection against the falling of drops of water and additional grids, with smaller holes, are installed behind the existing openings.

6.4 SPECIAL PAINT

Different colours are available on request and with an additional cost. The special paint can be requested according to the RAL colours standard.

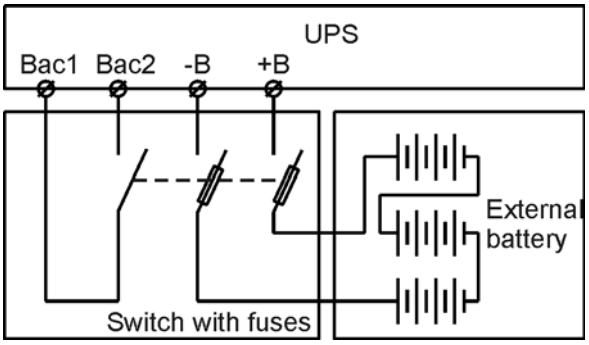
6.5 FUSED SWITCH FOR THE BATTERY

The fused switch for the battery is a switch with integrated fuses and it is used to separate the UPS from the external battery. The fused switch is necessary in installations where the batteries are installed in a dedicated battery room, so a sectioning device is necessary between the UPS and the battery.

It is mounted in a separate cabinet and it is equipped with free voltage contacts for the indication of the switch position (open-closed) and fuses condition.

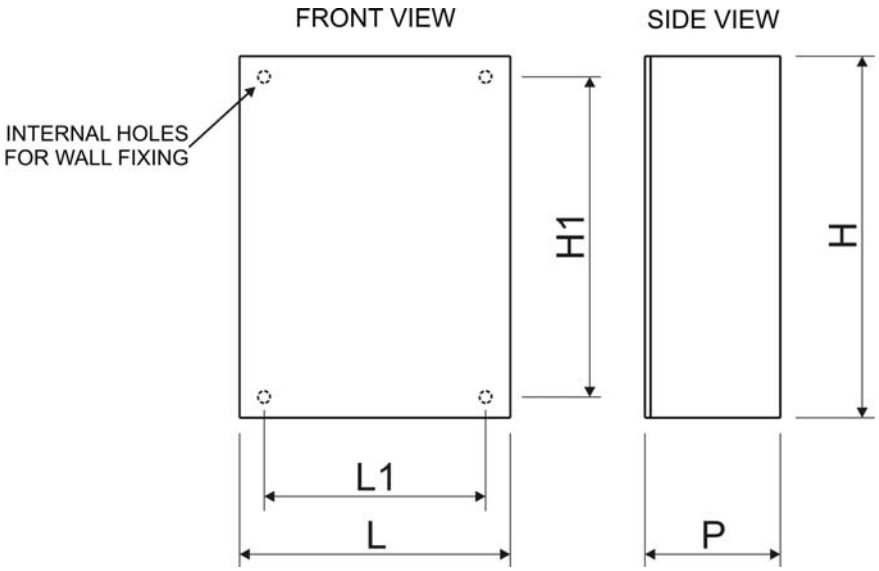
6.5.1 Connections

The battery switch with fuses is connected between the UPS and the external battery cabinet as illustrated below.



Picture 32 – Connection of the battery fused switch

6.5.2 Technical data



- Colour: RAL 7032
- Protection degree: IP20

UPS (kVA)	20	30	40	60	80
L – mm	400				500
P – mm	200				200
H – mm	400				700
L1 – mm	360				460
H1 – mm	360				660

UPS (kVA)	20	30	40	60	80
Switch type	2 pole fused switch				3 poles switch + fuses
Fuses size (A)	80 Gg	80 Gg	125 Gg	160 Gg	400 Gg

6.6 REMOTE EPO

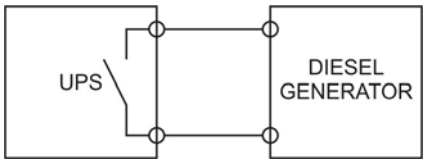
The voltage supply to the loads can be interrupted from a remote location by using the remote EPO option (i.e. for safety requirements). A normally closed contact must be connected to the UPS terminal board; when this contact is open the inverter and by-pass static switches are disabled so that the output supply is interrupted.

6.7 FANS MONITORING

For special applications it is possible to require the fans monitoring.
An additional monitoring card provides to activate the alarm (A20) on the LCD display in case of any fans failure.

6.8 DIESEL GENERATOR INTERFACE

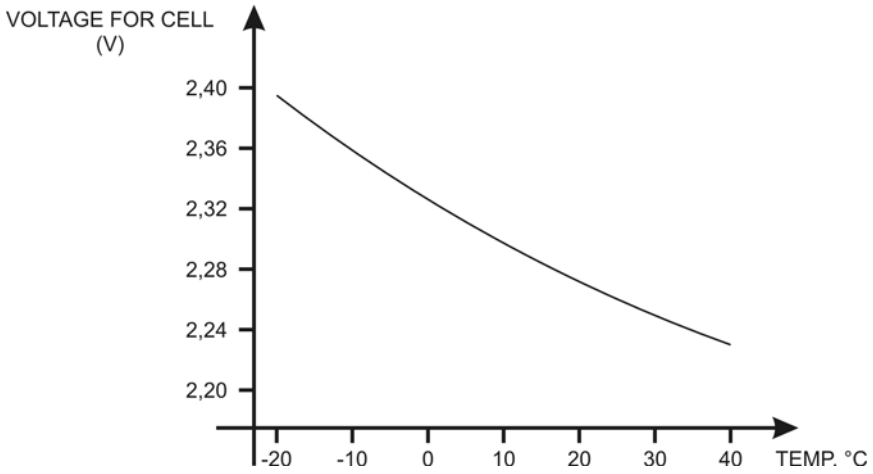
The diesel generator interface provides to limit the rectifier output voltage in order not to recharge the battery during the Gen Set operation. In this way the rectifier needs a lower current to feed the DC loads (inverter) and a considerable amount of energy is saved, therefore the rating of the generator power can be lower.
A volt-free contact indicating the Gen Set operation must be provided and connected to two additional terminals on the UPS terminal board.



Picture 33 – Diesel generator interface block diagram

6.9 THERMAL COMPENSATION BATTERY CHARGE

It consists of a temperature thermal sensor to be installed in the battery room (or battery cubicle) in order to detect the operating temperature.
This transducer is able to modify the charging voltage according to the typical curve supplied from the battery manufacturer. It is normally used for sealed batteries, which are particularly temperature sensitive.
This type of regulation ensures a proper charging voltage to the batteries in order to improve their operating life.

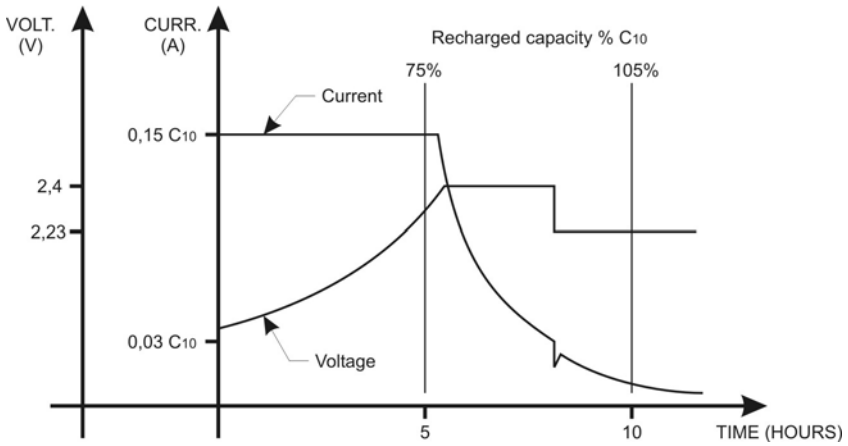


Picture 34 – Charging voltage vs. temperature

The temperature sensor is housed inside a plastic tube and already provided with a three-pole cable that must be connected to an interface card installed next to the UPS' terminal board section. The temperature sensor can be installed at a maximum distance of 15 meters from the UPS.

6.10 BOOST CHARGE

This type of charge, according to DIN41773, is used with vented lead acid (open type) or Ni-Cd batteries that have a wide voltage range (Pb: 2,2÷2,7 V/cell).



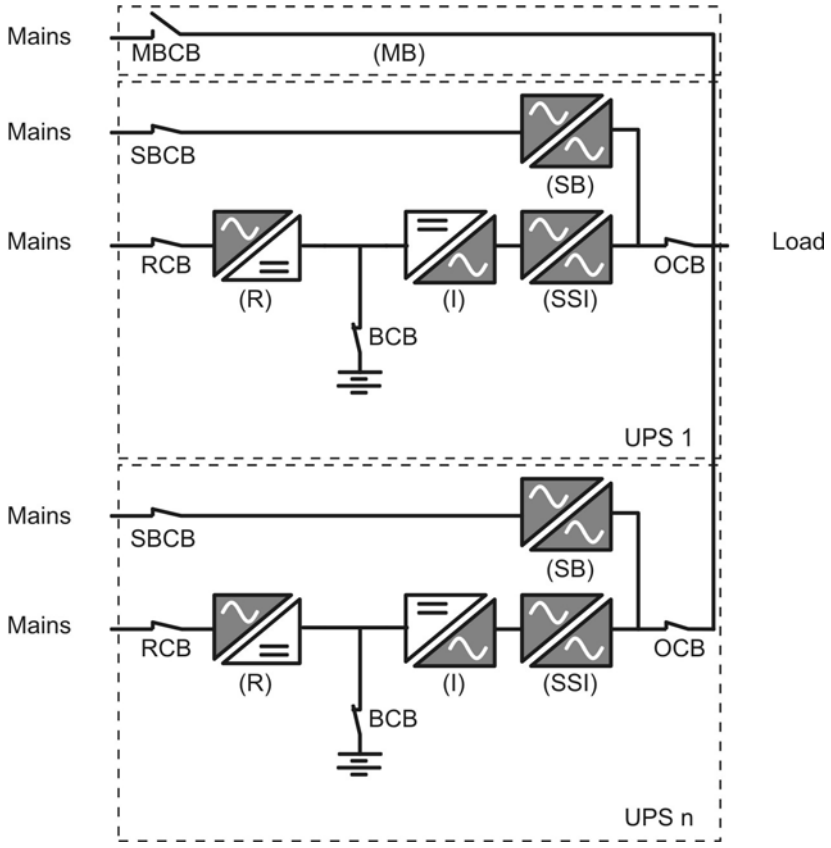
Picture 35 – BOOST charge diagram

In order to design the correct number of cells, the following table shows the voltage limits of the UPS. The maximum capacity is a function of the maximum recharging current, that can be found in the technical specification.

Minimum battery voltage	**326Vdc**
Maximum charging voltage	**490Vdc**

As soon as the battery charging current exceeds a certain threshold (generally 0,08C_{10}) the rectifier switches to BOOST charge (2,4 V/cell for lead acid batteries, 1,55 V/cell for Ni-Cd batteries) and starts a charging cycle with the first part at constant current as the voltage increases slowly. When the voltage reaches the boost charge level the current begins to decrease until it reaches the second threshold (generally 0,03C_{10}) and the rectifier is switched back to FLOATING charge.
During the boost charge mode the battery emits hydrogen owing to the chemical reaction that also causes the heating of the elements. In order to avoid the over-heating or excessive consumption of the electrolyte, the microprocessor is equipped with a safety timer that provides to stop the boost charge in case it exceeds 12 hours. An alarm indication on the display warns the user that something is wrong with the batteries.

6.11 PARALLEL REDUNDANT CONFIGURATION



Picture 36 – Parallel redundant block diagram

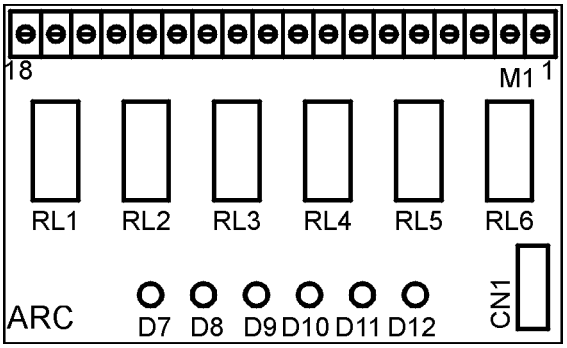
The parallel system consists of “n” (up to 4) units, which are equipped like standard units. Only the manual bypass can be external and unique for all the units (on request).
On each unit one extra pcb (RPI-BUSCAN), that provides the parallel redundant functions, is installed.
In addition to the standard functions as uninterruptible power supply, total power control and protection of the load from mains distortion, the parallel redundant system guarantees an uninterrupted power supply even in case of an internal failure in one of the UPS units.

It is possible because all units are constantly in operation and feed the load in parallel at “total load / n”, where “n” is the number of the UPS.
The AC automatic current sharing control equalizes the currents of the “n” units and reduces the total unbalance to less than 10%, under all load conditions.
The load is supplied by the inverters in parallel for an instantaneous overload up to “n x 200%” of the nominal load of a single unit.
In case of a failure in one unit, the other units supply the load. The load is supplied by the static bypass, only if there is an additional failure in the other units.

6.12 ARC – FREE VOLTAGE CONTACT CARD

The standard ARC card is used to repeat to a remote location some UPS status and alarms, by means of SPDT (Single-Pole-Double-Throw) voltage free contacts.
During normal operating conditions, with no alarms, all relays are energized.

Relay	Alarms/Status	Status	M1		Led	
			Pins	Status	Name	Status
RL1	Not available		17-18		D7	
			16-17			
RL2	Not available		14-15		D8	
			13-14			
RL3	Status = Inverter feeds the load	Energized	11-12	Closed	D9	On
			10-11	Open		
RL4	Alarm = Bypass feeds the load	Not energized	8-9	Open	D10	Off
			7-8	Closed		
RL5	Alarm = Battery low	Not energized	5-6	Open	D11	Off
			4-5	Closed		
RL6	Alarm = Mains fault	Not energized	2-3	Open	D12	Off
			1-2	Closed		



Picture 37 – ARC card layout

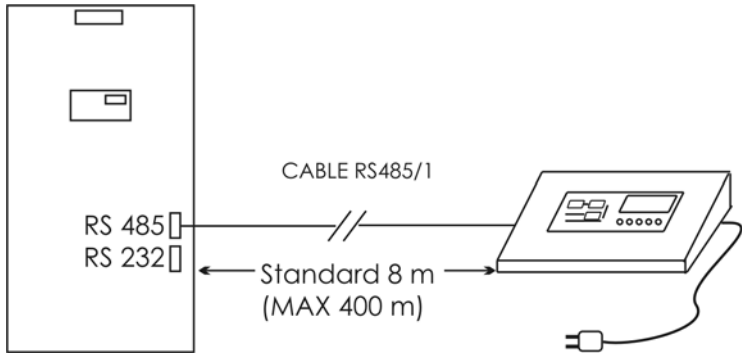
Relays specification: Voltage 120 VAC Current 1A
Voltage 50 VDC Current 1A DC1

6.13 ADDITIONAL ALARMS (INT5ARC + 2ARC)

The INT-5ARC is an interface able to multiply the free contacts related to the different function and alarm conditions up to a maximum of 12 (two additional ARC card) instead of the 4 provided by the standard ARC card (see paragraph 6.13).
The list of alarms (among the 25 provided by the UPS) must always be communicated during the order phase and cannot personalized on site but changing the software release of the UPS.

6.14 REMOTE PANEL

The remote operating panel is used for remote monitoring of the UPS for distance up to 400m, it can be installed in a control room, and provides the same user interface as the local panel.
Consistently with UPS front panel, it is based on 2x20 LCD display, leds, keys, silk-screen and buzzer. Up to 8 remote control panels may be connected to the UPS through the RS485 serial interface.



Picture 38 – Remote panel connection

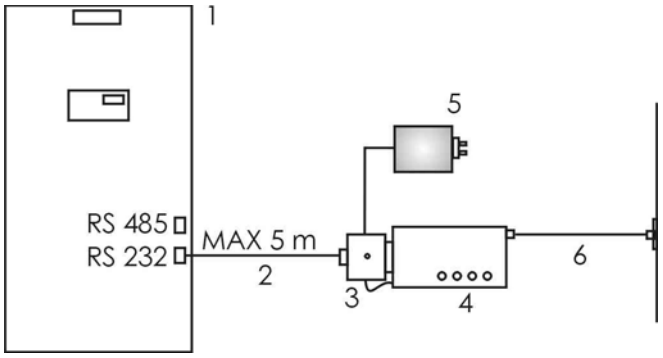
- Single remote panel dimensions: 320 x 210 x 60 mm (W x D x H)
- Power requirements: 220÷240Vac 50-60Hz

The remote panel includes:

- Remote panel with standard supply cable (L = 1m).
- RS485 connection cable (standard length 8m).

6.15 TELEPHONE CONNECTION KIT

This package provides hardware and software required to connect the UPS to a remote PC through a telephone line. The remote PC can dial the UPS through a modem and a dedicated line, check the status and read the information about alarms, if pending. The same package is required for the UPS REMOTE SERVICE.



1 – UPS
2 – RS232 connection cable
3 – UMI Interface
4 – Modem
5 – Power supply
(Input: 220÷240Vac/50-60Hz)
6 – Telephone wire

Picture 39 – UPS-Modem connection

The package is composed by:

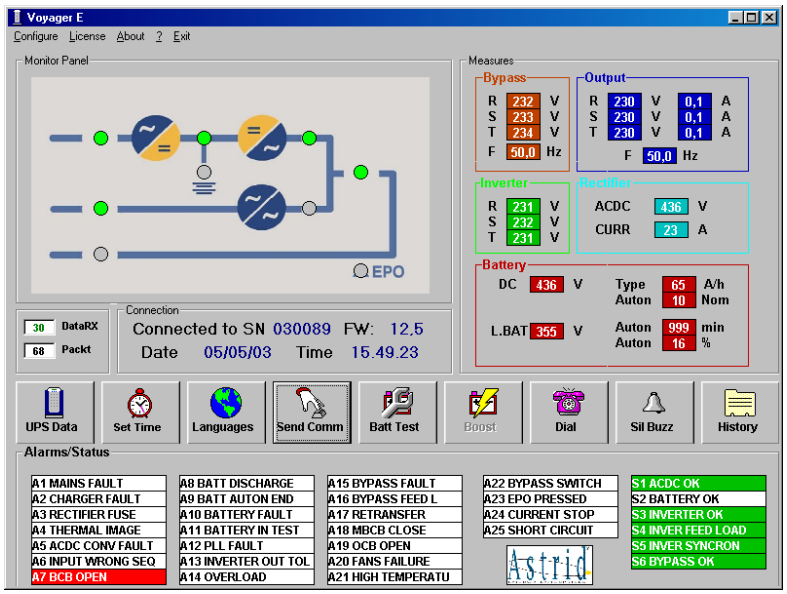
- Standard modem (with phone wire and AC/AC power supply with 1-meter cable).
- RS232 connection cable (standard length = 3m).
- UMI interface

NOTE

Control software for the remote PC is not provided.

6.16 MONITORING SOFTWARE VOYAGER/E

The software Voyager E is a UPS monitoring software running under Windows environment. The host PC has to be connected to the RS-232 port of the UPS by means of the cable contained in the Voyager Kit. The software allows to monitor the UPS from a PC and to send the UPS commands (protected by password) to the UPS.
The Voyager E does not enable the UPS shutdown through the PC or the Server.
The program can work in background while other programs are in use, and in case of an alarm the UPS control screen is visualized (pop-up function).
The program allows to translate into another language all the labels present in the various formats.
Italian, English and German version are available as standard.



Picture 40 – Voyager/E screen

The VOYAGER/E package includes:

- Software VOYAGER E CD-ROM + manual (PDF format) on CD

Supported operating systems: WINDOWS platforms (Win95 or higher)

The software Voyager/E contained in the CD gives the license to connect to a minimum of 1 UPS to a maximum of 10 UPS. Each software installation enables the connection to only one UPS. Voyager/E is developed by Astrid SpA. If there are any questions or comments about this product, please feel free to contact us.

6.17 UPS MANAGEMENT SOFTWARE

The UPS-Management software is basically the software required for the shutdown of the server connected to the UPS. It is provided with a single license key, that is valid for using the UPS service on one server with one UPS and an unlimited number of connected UPSMON-WINDOWS workstations. For operation on several servers a license for every new server is required, disregarding the fact if UPS service runs at that location or if the server is halted by a UPS service via remote command RCCMD.
The PC must be connected to the UPS through a direct RS232 connection having a maximum length of 5-6 meters; the UPS can also be connected to the network by a SNMP adapter (see paragraph 6.20) in case the PC is located far from it and the direct connection via RS232 is not possible.
The CD-ROM allows the installation of only one UPSMAN software. Additional licenses can be requested for several multi-server shutdown installations (see next paragraph).

6.18 ADDITIONAL LICENSES FOR UPS MANAGEMENT SOFTWARE

The additional licenses allow the installation of the RCCMD (Remote Console CoMmanD) service in the servers where the shutdown is required. This service enable the servers to “listen” to the RCCMD commands sent through the network by the UPSMAN (that is the PC where the management software is installed), thus commanding a shutdown when requested by the user.

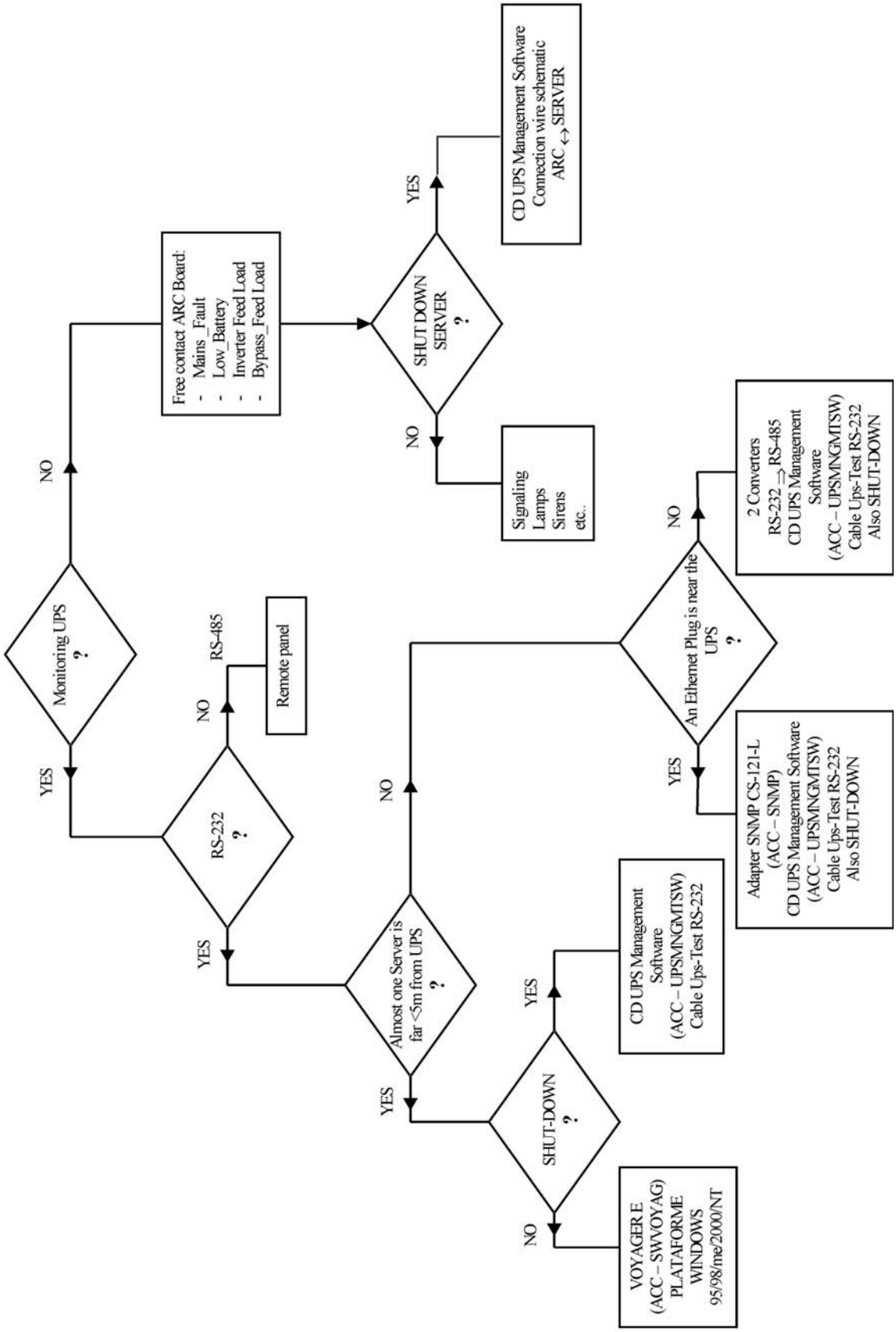
6.19 SNMP (SIMPLE NETWORK MANAGEMENT PROTOCOL) ADAPTER

The SNMP adapter converts the UPS protocol into Internet protocol (TCP/IP), so that all the operating variables are available in the network. The SNMP adapter can be associated with the UPS management software, which provides a monitoring tool and a shutdown utility for the server connected to the UPS.

6.20 JBUS/MODBUS INTERFACE

The JBUS adapter converts the data-stream coming from the UPS into a J-BUS protocol, which is a subset of the MODBUS protocol.
The connection to the UPS is done by a special cable between the COM1 and the RS-232 interface of the UPS.
The connection to the MODBUS-Master is done by either using the RS-232 (COMA) or the RS-485. On the rear plate the configured interface is marked.

6.21 SELECTION OF THE UPS-USER INTERFACE



7 SPARE PARTS LIST

7.1 INTRODUCTION

The spare parts for PLANET/E are divided into three different levels:

- Level 1: fuses
- Level 2: electronic cards
- Level 3: semiconductors, fans, capacitors

7.2 SPARE PARTS FOR HALLEY/E 20KVA

7.2.1 Level 1

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
FN001_6.3X32	AUXILIARY FUSES	6,3x32 1A		**2**
FN1.6_5X20	FANS FUSES	5x20 1,6A		**2**
FN050URGX51	STATIC BYPASS POWER FUSES	14x51 50A URGB	3	**3**
FN063_GGX58	BATTERY POWER FUSES	22x58 63 gG	2	**2**

7.2.2 Level 2

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB001	POWER SUPPLY HV	PS-HV	1	**1**
PB003+PB011+PB012 +PB014	INVERTER STATIC SWITCH CONTROL LOGIC 1/F	I/S-CL	1	**1**
PB009	SCR BRIDGES FIRING 3/F	SCRSF-3F	1	**1**
PB013	IGBT DRIVE	ID	3	**2**
PB004	INVERTER ACTUAL VALUE 3/F	INV-AV-3F	1	**1**
PB005	VOLTAGE REFERENCE 3/F	VOLT-REF-3F	1	**1**
PB113	SCR FIRING	FIR-91	1	**1**
PB114	RECTIFIER CONTROL LOGIC POWER SUPPLY	PRCH	1	**1**
PB115	RECTIFIER CONTROL LOGIC	LOOP	1	**1**
PB121-122	SYSTEM CONTROL PANEL E	SCP-E	1	**1**

7.2.3 Level 3

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
SCRD56A12V	RECTIFIER BRIDGE POWER MODULE	56A 1200V	3	**2**
IGD75A12V	IGBT INVERTER POWER BRIDGE	75A 1200V	3	**2**
SCRD56A12V	INVERTER STAT.SWITCH THYRISTORS	56A 1200V	3	**1**
SCRD56A12V	BYPASS STAT.SWITCH THYRISTORS	56A 1200V	3	**1**
VA150D230V	FAN	ϕ 150mm 230Vac	2	**2**
CC2200U500V	DC CAPACITORS 2200uF 500V	2200uF 500Vdc	3	**2**
CA100U250V	AC FILTER CAPACITORS 100uF-250V	100uF 250Vac	3	**1**

7.2.4 Additional spares

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB120	INVERTER BRIDGE POWER CARD	IBPC-7	1	**2**
PB046	INPUT/OUTPUT RFI FILTER	EMIF-3F	2	**1**
TAH0100A	HALL EFFECT CURRENT TRANSFORMER	100A	1	**1**
ACM7001	CURRENT TRANSFORMER	30-60/0,1A	3	**1**

7.3 SPARE PARTS FOR HALLEY/E 30KVA

7.3.1 Level 1

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
FN001_6.3X32	AUXILIARY FUSES	6,3x32 1A		**2**
FN1.6_5X20	FANS FUSES	5x20 1,6A		**2**
FN100URGX58	STATIC BYPASS POWER FUSES	14x51 100A URGB	3	**1**
FN063_GGX58	BATTERY POWER FUSES	22x58 63 gG	2	**2**

7.3.2 Level 2

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB001	POWER SUPPLY HV	PS-HV	1	**1**
PB003+PB011+PB012 +PB014	INVERTER STATIC SWITCH CONTROL LOGIC 1/F	I/S-CL	1	**1**
PB009	SCR BRIDGES FIRING 3/F	SCRSF-3F	1	**1**
PB013	IGBT DRIVE	ID	3	**2**
PB004	INVERTER ACTUAL VALUE 3/F	INV-AV-3F	1	**1**
PB005	VOLTAGE REFERENCE 3/F	VOLT-REF-3F	1	**1**
PB113	SCR FIRING	FIR-91	1	**1**
PB114	RECTIFIER CONTROL LOGIC POWER SUPPLY	PRCH	1	**1**
PB115	RECTIFIER CONTROL LOGIC	LOOP	1	**1**
PB121-122	SYSTEM CONTROL PANEL E	SCP-E	1	**1**

7.3.3 Level 3

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
SCRD91A12V	RECTIFIER BRIDGE POWER MODULE	91A 1200V	3	**2**
IGD100A12V	IGBT INVERTER POWER BRIDGE	100A 1200V	3	**2**
SCRD56A12V	INVERTER STAT.SWITCH THYRISTORS	56A 1200V	3	**1**
SCRD56A12V	BYPASS STAT.SWITCH THYRISTORS	56A 1200V	3	**1**
VA150D230V001	FAN	ϕ 150mm 230Vac	2	**2**
CC2200U500V	DC CAPACITORS 2200uF 500V	2200uF 500Vdc	3	**2**
CA200U250V	AC FILTER CAPACITORS 200uF-250V	200uF 250Vac	3	**1**

7.3.4 Additional spares

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB120	INVERTER BRIDGE POWER CARD	IBPC-7	1	**2**
PB046	INPUT/OUTPUT RFI FILTER	EMIF-3F	2	**1**
TAH0100A	HALL EFFECT CURRENT TRANSFORMER	100A	1	**1**
ACM7001	CURRENT TRANSFORMER	30-60/0,1A	3	**1**

7.4 SPARE PARTS FOR HALLEY/E 40KVA

7.4.1 Level 1

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
FN001_6.3X32	AUXILIARY FUSES	6,3x32 1A		**2**
FN1.6_5X20	FANS FUSES	5x20 1,6A		**4**
FN100URGX58	RECTIFIER FUSES	14x51 100A URGB	3	**3**
FN100URGX58	STATIC BYPASS POWER FUSES	14x51 100A URGB	3	**1**

7.4.2 Level 2

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB001	POWER SUPPLY HV	PS-HV	1	**1**
PB003+PB011+PB012 +PB014	INVERTER STATIC SWITCH CONTROL LOGIC 1/F	I/S-CL	1	**1**
PB010	SCR BRIDGES FIRING 1/F	SCRSF-1F	3	**2**
PB047	FREE CONTACT INTERFACE	FCI	1	**1**
PB013	IGBT DRIVE	ID	3	**2**
PB004	INVERTER ACTUAL VALUE 3/F	INV-AV-3F	1	**1**
PB005	VOLTAGE REFERENCE 3/F	VOLT-REF-3F	1	**1**
PB116	RECTIFIER CONTROL LOGIC POWER SUPPLY	SYNC-12	1	**1**
PB117	RECTIFIER CONTROL LOGIC	RCLS-1	1	**1**
PB121-122	SYSTEM CONTROL PANEL E	SCP-E	1	**1**

7.4.3 Level 3

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
SCRD132A12V	RECTIFIER BRIDGE POWER MODULE	132A 1200V	3	**2**
IGD200A12V	IGBT INVERTER POWER BRIDGE	200A 1200V	3	**2**
SCRD56A12V	INVERTER STAT.SWITCH THYRISTORS	56A 1200V	3	**1**
SCRD91A12V	BYPASS STAT.SWITCH THYRISTORS	91A 1200V	3	**1**
VA150D230V	FAN	ϕ 150mm 230Vac	5	**3**
CC2200U500V	DC CAPACITORS 2200uF 500V	2200uF 500Vdc	4	**2**
CA200U250V	AC FILTER CAPACITORS 200uF-250V	200uF 250Vac	3	**1**

7.4.4 Additional spares

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB046	INPUT/OUTPUT RFI FILTER	EMIF-3F	2	**1**
PB040	BATTERY RFI FILTER	EMIF-B	1	**1**
TAH0300A	HALL EFFECT CURRENT TRANSFORMER	300A 2000:1	1	**1**
ACM7002	CURRENT TRANSFORMER	80-130-160/0,1A	3	**1**

7.5 SPARE PARTS FOR HALLEY/E 60KVA

7.5.1 Level 1

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
FN001_6.3X32	AUXILIARY FUSES	6,3x32 1A		**2**
FN1.6_5X20	FANS FUSES	5x20 1,6A		**4**
FN160_ARNH00	RECTIFIER FUSES	NH00 160A aR	3	**3**
FN160_ARNH00	STATIC BYPASS POWER FUSES	NH00 160A aR	3	**1**

7.5.2 Level 2

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB001	POWER SUPPLY HV	PS-HV	1	**1**
PB003+PB011+PB012 +PB014	INVERTER STATIC SWITCH CONTROL LOGIC 1/F	I/S-CL	1	**1**
PB010	SCR BRIDGES FIRING 1/F	SCRSF-1F	3	**2**
PB047	FREE CONTACT INTERFACE	FCI	1	**1**
PB013	IGBT DRIVE	ID	3	**2**
PB004	INVERTER ACTUAL VALUE 3/F	INV-AV-3F	1	**1**
PB005	VOLTAGE REFERENCE 3/F	VOLT-REF-3F	1	**1**
PB116	RECTIFIER CONTROL LOGIC POWER SUPPLY	SYNC-12	1	**1**
PB117	RECTIFIER CONTROL LOGIC	RCLS-1	1	**1**
PB121-122	SYSTEM CONTROL PANEL E	SCP-E	1	**1**

7.5.3 Level 3

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
SCRD132A12V	RECTIFIER BRIDGE POWER MODULE	132A 1200V	3	**2**
IGD300A12V	IGBT INVERTER POWER BRIDGE	300A 1200V	3	**2**
SCRD91A12V	INVERTER STAT.SWITCH THYRISTORS	91A 1200V	3	**1**
SCRD91A12V	BYPASS STAT.SWITCH THYRISTORS	91A 1200V	3	**1**
VA150D230V	FAN	ϕ 150mm 230Vac	5	**3**
CC2200U500V	DC CAPACITORS 2200uF 500V	2200uF 500Vdc	5	**2**
CA400U250V	AC FILTER CAPACITORS 400uF-250V	400uF 250Vac	3	**1**

7.5.4 Additional spares

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB046	INPUT/OUTPUT RFI FILTER	EMIF-3F	2	**1**
PB040	BATTERY RFI FILTER	EMIF-B	1	**1**
TAH0300A	HALL EFFECT CURRENT TRANSFORMER	300A 2000:1	1	**1**
ACM7002	CURRENT TRANSFORMER	80-130-160/0,1A	3	**1**

7.6 SPARE PARTS FOR HALLEY/E 80KVA

7.6.1 Level 1

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
FN001_6.3X32	AUXILIARY FUSES	6,3x32 1A		**2**
FN1.6_5X20	FANS FUSES	5x20 1,6A		**4**
FN200_ARNH00	RECTIFIER FUSES	NH00 200A aR	3	**3**
FN200_ARNH00	STATIC BYPASS POWER FUSES	NH00 200A aR	3	**1**

7.6.2 Level 2

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB001	POWER SUPPLY HV	PS-HV	1	**1**
PB003+PB011+PB012 +PB014	INVERTER STATIC SWITCH CONTROL LOGIC 1/F	I/S-CL	1	**1**
PB010	SCR BRIDGES FIRING 1/F	SCRSF-1F	3	**2**
PB047	FREE CONTACT INTERFACE	FCI	1	**1**
PB013	IGBT DRIVE	ID	3	**2**
PB004	INVERTER ACTUAL VALUE 3/F	INV-AV-3F	1	**1**
PB005	VOLTAGE REFERENCE 3/F	VOLT-REF-3F	1	**1**
PB116	RECTIFIER CONTROL LOGIC POWER SUPPLY	SYNC-12	1	**1**
PB117	RECTIFIER CONTROL LOGIC	RCLS-1	1	**1**
PB121-122	SYSTEM CONTROL PANEL E	SCP-E	1	**1**

7.6.3 Level 3

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
SCRD132A12V	RECTIFIER BRIDGE POWER MODULE	132A 1200V	3	**2**
IGD400A12V01	IGBT INVERTER POWER BRIDGE	400A 1200V	3	**2**
SCRD91A12V	INVERTER STAT.SWITCH THYRISTORS	91A 1200V	3	**1**
SCRD132A12V	BYPASS STAT.SWITCH THYRISTORS	132A 1200V	3	**1**
VA150D230V001	FAN	ϕ 150mm 230Vac	6	**3**
CC2200U500V	DC CAPACITORS 2200uF 500V	2200uF 500Vdc	5	**2**
CA400U250V	AC FILTER CAPACITORS 400uF-250V	400uF 250Vac	3	**1**

7.6.4 Additional spares

ASTRID CODE	DESCRIPTION	TYPE / VALUE	QUANTITY	
			Inst.	Rec.
PB046	INPUT/OUTPUT RFI FILTER	EMIF-3F	2	**1**
PB040	BATTERY RFI FILTER	EMIF-B	1	**1**
TAH0200A	HALL EFFECT CURRENT TRANSFORMER	300A 2000:1	1	**1**
ACM7002	CURRENT TRANSFORMER	80-130-160/0,1A	3	**1**